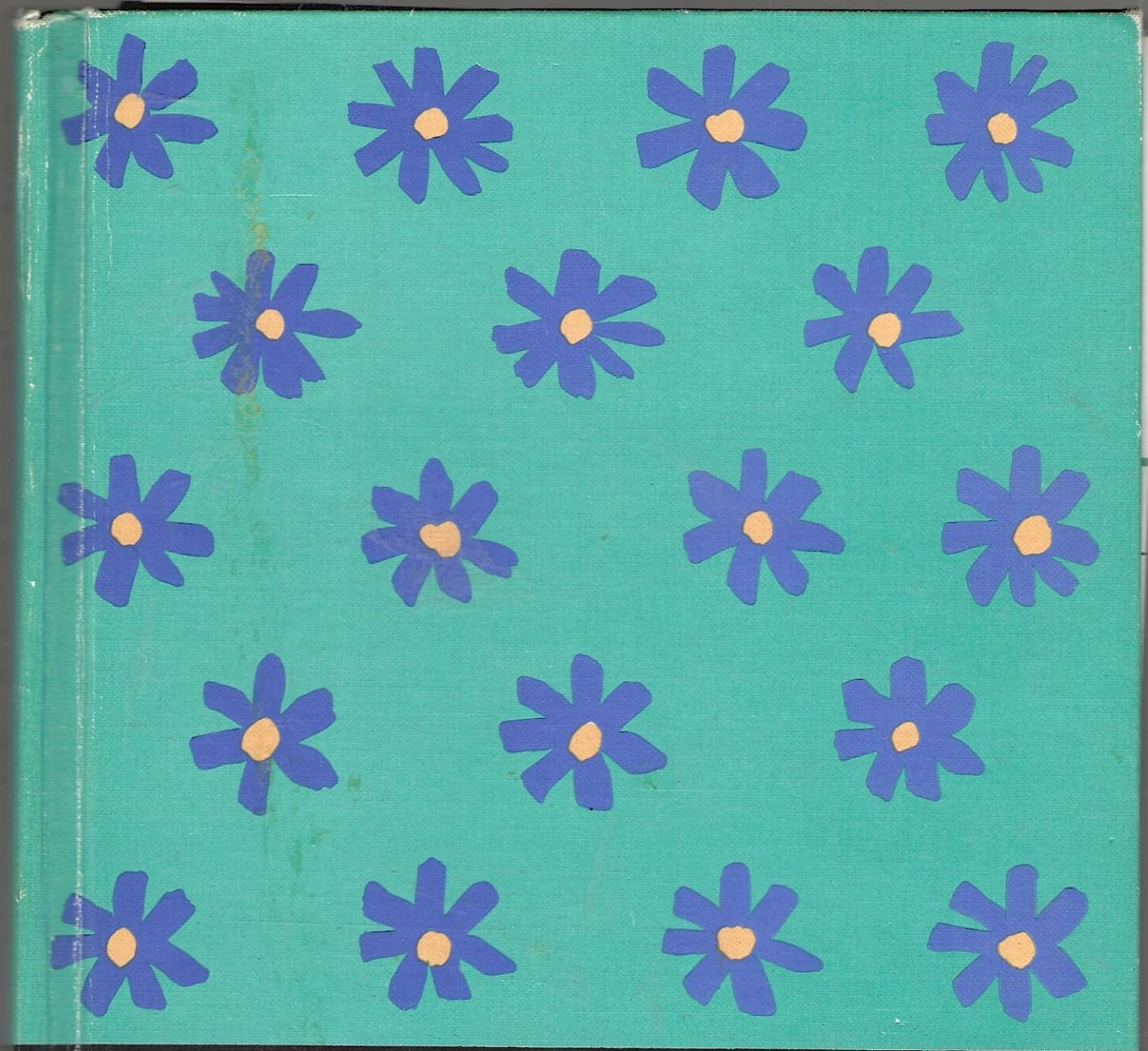

Arithmetic in My World

ARITHMETIC IN MY WORLD

8

ILLUSTRATORS

Cheslie D'Andrea
W. Gordon Smith
Kenneth Wagner

The authors believe that the learning and teaching of arithmetic is based on child growth. Through the study of many thousands of children and their problems, they have determined how and what children should learn in order to establish desirable growth patterns. They have found that children's problems can be organized into units of work composed of activities which are in reality areas of development.

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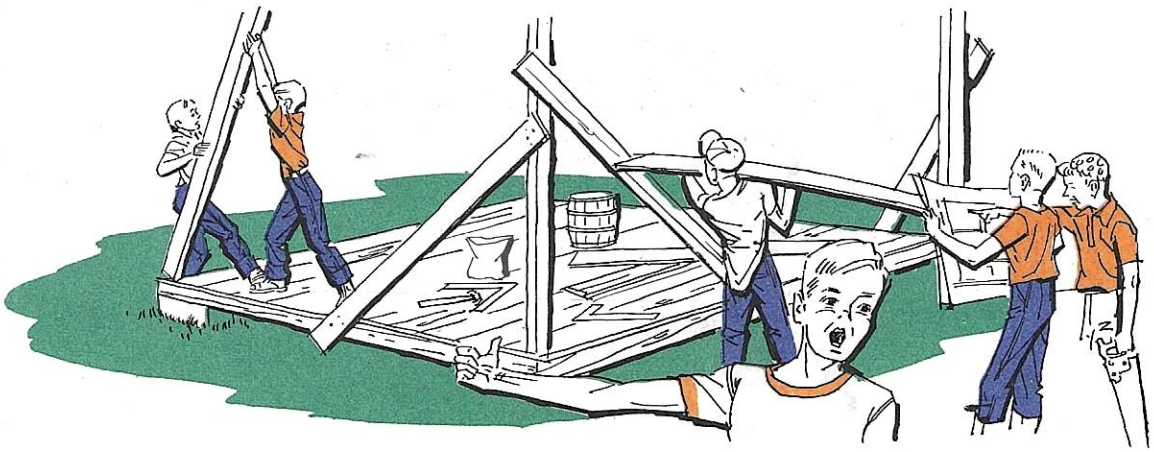
Arithmetic

IN MY WORLD

by

C. Newton Stokes
Paul J. Whiteley
Anne Beattie

8



1958

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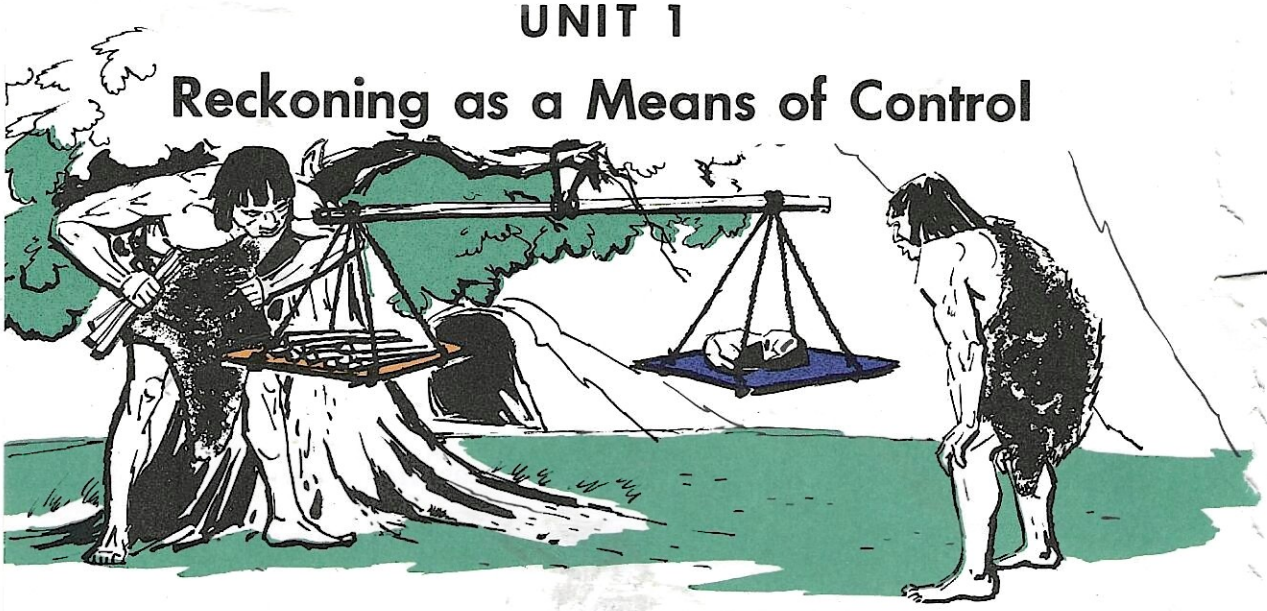
UNIT 1

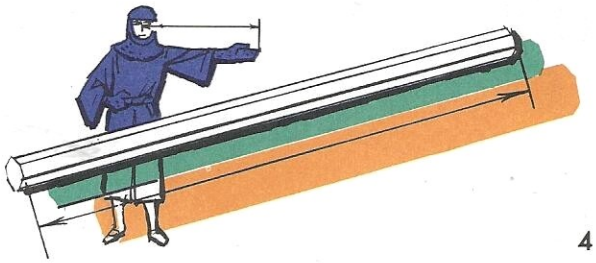
Reckoning as a Means of Control



Cubit, one of the earliest forms of measurement

Barleycorns, an early standard that was universally available

The Iron Ulna, one of the first standards



Micrometer, the first precision measuring instrument

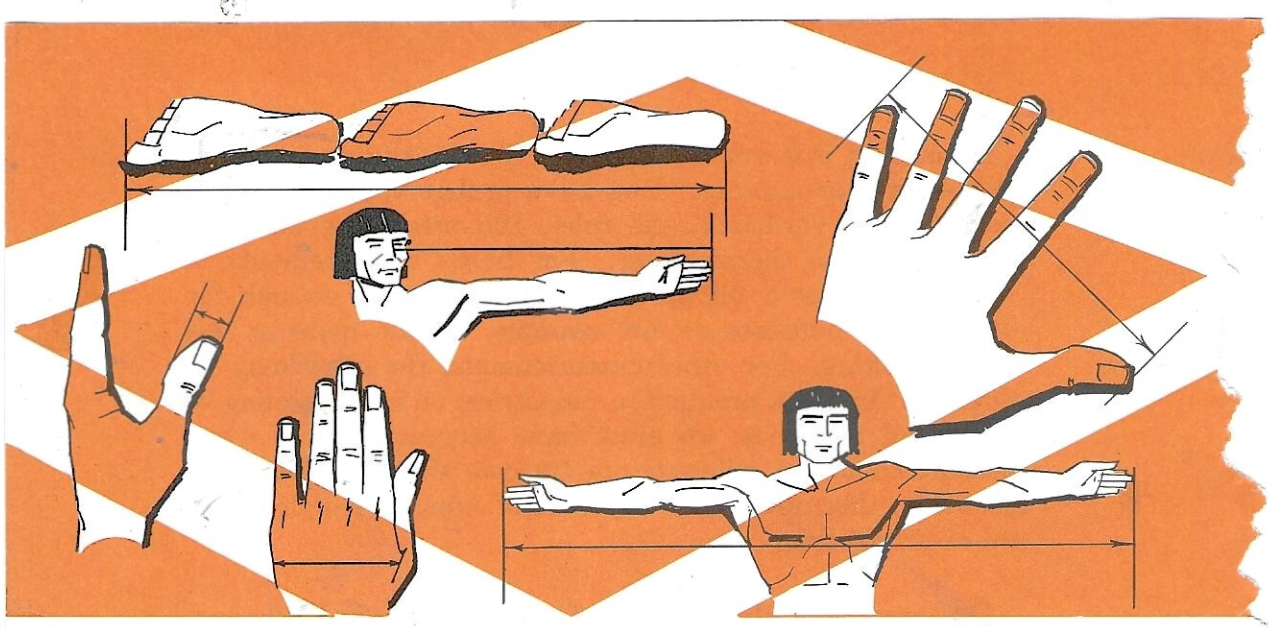
Measuring instruments are used in all American homes in one form or another. You have probably seen the tape measure, the yardstick, the ruler, the measuring cup and spoon, and the thermometer. For home measurements, a "little more" or a "little less" is usually close enough for all practical purposes as, for example, a little more or less salt in cooking. For other measurements, the story may be different. In mass production industries, or in the timing of trains and airplanes, we must have accuracy. Only when measurements are followed exactly can assembly lines run smoothly. Accuracy is the keystone of America's high standard of production.

Do you know the history of measurement? Each succeeding civilization added its bit to mankind's knowledge of measurement, and an accumulation of measuring standards was built up.

Some civilizations contributed weight measures; some, how to measure time; some, like the Egyptians, showed us how to measure land. In the 13th century King Edward of England, to avoid confusion and argument, had made a permanent measuring stick out of iron. This was called the "iron ulna." Its length was, surprisingly enough, about the length of our yard. He also decreed that 3 feet or 36 inches should equal the yard.

In 1799, the French government adopted an entirely new system of measurement called the metric system. It used multiples of ten in its measures. This new system proved so confusing to the French people that, after 19 years, they went back to their old system of measuring. However, in 1837, the French nation again adopted the metric system and has used it ever since. When our country became a nation, we followed the English system of measuring.

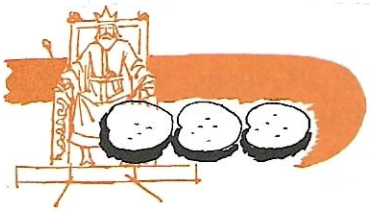
Today standards of measurement are carefully preserved in Washington, London, and Paris.



Measurement as a Social Tool

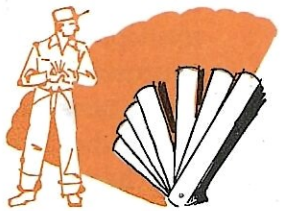
Measurements have progressed through thousands of years of time. All of the advances that measurement has made we call the *science of measurement.* Of course, these advances came about gradually, based on certain advancements in civilization. The only reason the worker of today can be more accurate than the worker of yesterday is because he has learned to use finer measuring devices. Today's knowledge of measurement is based on rules of nature — on airflow, light waves, and radio waves.

You, in your progress through mathematics, must understand the various stages of accuracy needed in today's world.



Barleycorn:
accuracy within
tenths of an inch
.X

Micrometer:
accuracy within
thousandths of an inch
.00X



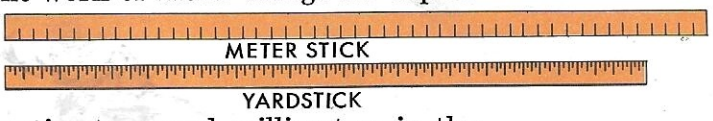
Thickness gauge:
accuracy within
ten-thousandths of an inch
.000X

Some Modern Instruments for Measuring

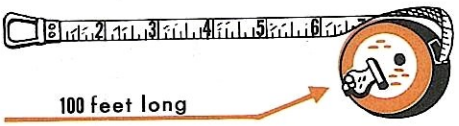
Do you realize you can never measure anything exactly? You must try to reach a degree of accuracy necessary for the particular work you are doing. This depends on the instrument you are using.

The **carpenter's rule.** This may be a 2-foot or a 6-foot folding rule. It may be divided into sixteenths of an inch on one part, eighths on another part, or twelfths on another part. This rule is as accurate as a carpenter needs.

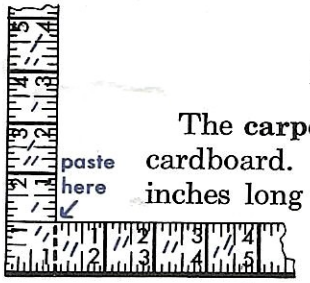
The **meter stick.** Most factories that do scientific instrument work or make things for export use instruments based on the metric system. The meter stick is subdivided into decimeters, centimeters, and millimeters in the tens relation. Measurements in general machine work can often be made as accurately as one fiftieth of a millimeter.



The **steel tape.** This is used to measure longer distances than the carpenter's rule. It is 100 feet long, and is rolled into a compact cover. It is subdivided into feet, inches, and eighths of an inch. Also, there is a tape where the parts of the foot are in the tens relation.

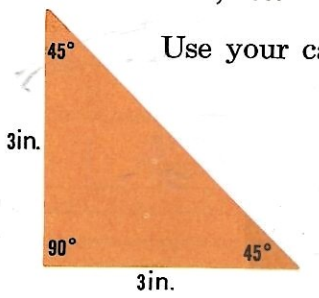


The **tape measure.** This is a measure used in tailoring and sewing. The parts are inches, half inches, quarter inches, eighth inches and sixteenth inches.

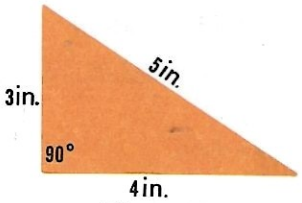


Making Your Own Instruments

The **carpenter's square.** Obtain a piece of heavy paper or cardboard. Cut a strip one inch wide and make it as many inches long as you like. Make another strip like the first one. Put the two pieces together as shown in the illustration. Paste the two strips together so that 1 inch of one paper covers 1 inch of the other strip. Then divide both strips into inches, half inches, etc.



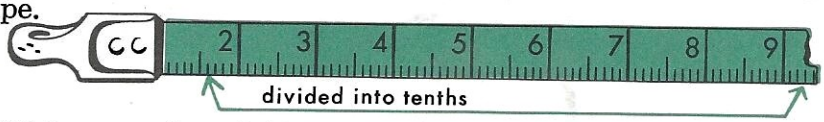
Use your carpenter's square and make a **draftsman's triangle.** Measure a 3-inch length on cardboard with your square. Use this as a base and measure a 3-inch height, forming a square corner. Connect the ends of the 2 lines making a triangle. You now have a right triangle. Cut out this triangle and you have a draftsman's triangle. This instrument is used by architects and draftsmen.



Use your square to construct another triangle. With your square, mark off a line of 4 inches and an upright line of 3 inches. Connect the ends of these lines to form a triangle. You will find that you have a triangle whose sides are 3 inches, 4 inches, and 5 inches.

Use your square to construct a $6'' \times 8'' \times 10''$ triangle.

This is a picture of a **surveyor's chain** or steel measuring tape.



Make a section of this instrument. You notice it is divided into tenths of inches instead of eighths or sixteenths. Use heavy paper or cardboard.

Use your surveyor's chain to measure lines of 3.2 in., $5\frac{1}{5}$ in., 3.6 in., 1.7 in., $5\frac{3}{5}$ in., $7\frac{1}{10}$ in.

Accuracy in Measurements

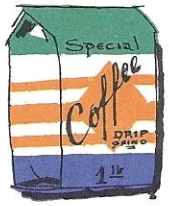
You saw pictures of a few instruments on Page 7 with the degree of accuracy you could expect from them. Sometimes nature has a way of changing a measuring stick.

Is a cloth tape affected by damp weather?

Would weather have any effect on instruments made of wood or steel?

Would it matter in ordinary measurements whether or not the weather affected the instruments?

When the distance around the earth is said to be 25,000 miles, is this exact?



If you buy a pound of coffee, is it possible that you may be given a fraction more or less than a pound?

Would this be the fault of the measuring instrument, or the person who did the measuring?

For all instruments of measure there are standards. A **standard measure** is that measure which is fixed by law. There is a standard yard, a standard bushel, a standard meter, etc. All standards of measure are carefully preserved in the Bureau of Standards at Washington, D.C. The United States government requires that everyone who makes measuring instruments conform to these standards.

Suppose you measured the length and width of the classroom. Would you want it correct to the nearest inch, half inch, or quarter inch? The degree of accuracy depends on what is to be measured, and which measuring instrument you use. You must decide how accurate you want your measurement to be.

If ten of you measure the blackboard length in class and record your measurements on the board, whose answer is correct? How can you find an answer that is most nearly correct? You can find the **average** of the ten measurements. You then have the result of 10 people measuring instead of one.

Using the Tools of Measurement

Without scientific instruments it is impossible to be absolutely accurate. However, you should try to obtain as accurate a measurement as you can. Sometimes you can create your own instrument. Suppose you want to measure the length and width of the schoolyard. Try the following:

1. Measure a piece of string one rod long ($16\frac{1}{2}$ feet), using yardstick or ruler. Then, by using this string as a measuring tool, measure the length and width of the schoolyard in rods.

2. Obtain a cloth tape measure to find the size of gloves that you wear. Measure around the palm of the hand in inches. This is your glove size.

3. To find your stocking size, measure the length of your foot in inches.

4. Measure these lines with your ruler.

a. _____

b. _____

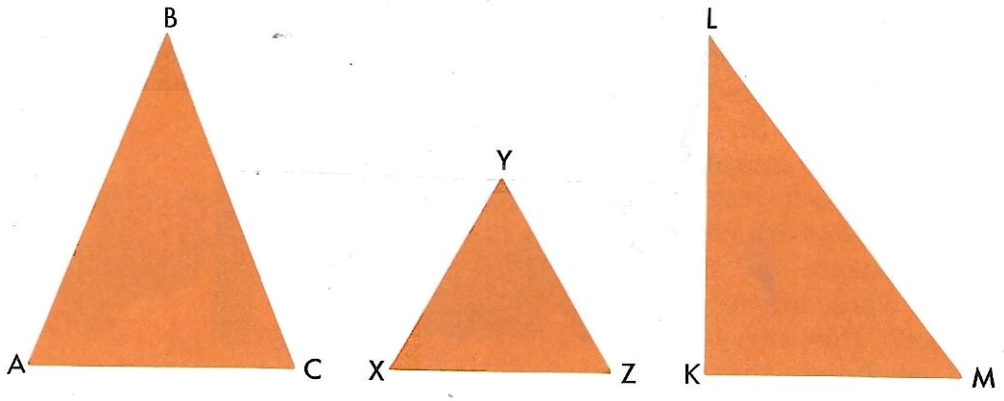
c. _____

d. _____

e. _____

Put five measurements for each line on the board. Decide which measurement is correct.

5. Measure the sides of these triangles with your ruler:



Isosceles triangle, two sides equal

Equilateral triangle, all sides equal

Right triangle, contains a 90° angle at K

Correcting Deficiencies in Measuring

On the preceding page, you tried to measure as accurately as possible with the tools you had.

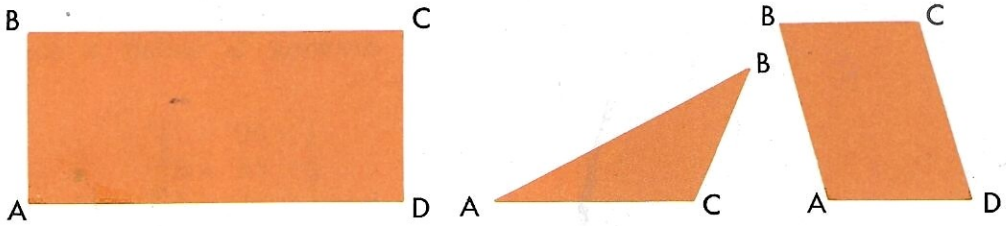
There are degrees of accuracy, and you must decide whether a measure must be accurate or nearly so. The rough scaffolding on a building must be firm and strong, but the wood does not have to fit perfectly, as it does when a carpenter is laying hardwood floors. A man must have the correct hat size, or he finds it embarrassing to wear the hat.

Exercises in Measurement

1. With a yardstick, measure lines of the following lengths on the blackboard: **a.** $16\frac{7}{8}$ inches, **b.** 2 feet $5\frac{1}{2}$ inches, **c.** $32\frac{3}{4}$ in. Have other members of the class check these measurements.

2. Use your ruler to draw lines on paper of the following lengths: $3\frac{3}{4}$ in., $1\frac{5}{8}$ in., $2\frac{11}{16}$ in., $2\frac{15}{16}$ in., $3\frac{1}{4}$ in., $2\frac{3}{8}$ in., $1\frac{11}{16}$ in., $2\frac{7}{8}$ in. Exchange papers with your neighbor, and check each other's work.

3. Measure all sides of these figures:



Rectangle Triangle Parallelogram

4. Measure the dimensions of the American flag in your classroom with a tape measure. Then, measure the length and width of the part containing the stars.

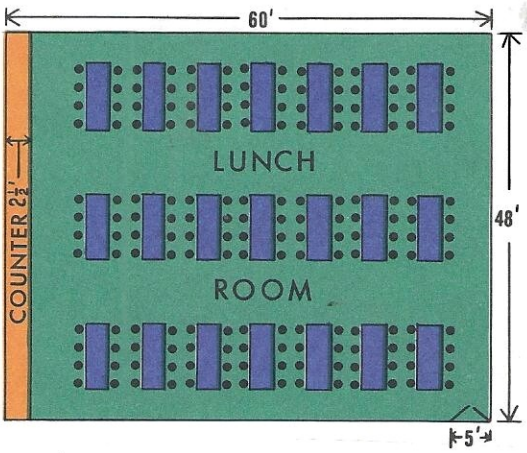
5. Divide the class into groups of 5. Each group choose something to measure in the room, such as the floor, the door, a desk, a picture, or a blackboard. Use the instrument you think best for the job. Each group compare answers to decide which answers are most accurate.

A Measurement Project

Miss Spencer's eighth-grade class decided to do some measuring themselves. They decided to measure the school lunchroom. Don was appointed to pace off the length and width of the room. The length of his pace was about 3 ft. He found it to be 20 paces by $15\frac{1}{2}$ paces. Jane said that would be approximately 60 ft. by $46\frac{1}{2}$ ft. Was she right? James and Harry then used a steel tape and found the room to be $60\frac{1}{2}$ ft. by 48 ft. How much more accurate was the steel tape?

Mary and Helen used the yardstick to measure the lunch counter. It measured 48 ft. by $2\frac{1}{2}$ ft. John used the foot ruler to measure the width of the double doors. He found these to be 5 feet wide.

Miss Spencer suggested that they put all this information in picture form on a piece of paper. Since the actual measurements could not be put on a small piece of paper, they had to cut them down to scale. The papers the class used were 11 inches by $8\frac{1}{2}$ inches. They decided to use a scale of $\frac{1}{8}$ inch to one foot. This kind of drawing is called a scale drawing.



$\frac{1}{8} \times 60' = 7\frac{1}{2}''$
$\frac{1}{8} \times 48' = 6''$
$\frac{1}{8} \times 2\frac{1}{2}' = \frac{5}{16}''$
$\frac{1}{8} \times 5' = \frac{5}{8}''$

1. Make a scale drawing of a baseball diamond 90 feet on each side. Pitcher's box is 60 feet 6 inches from home plate.

2. Marilyn wanted to plant a small vegetable garden. Her father told her to make a scale drawing of what she wanted and he would help her with the project. She decided on a space 6 ft. by 9 ft. The rows of plants were to be 1 foot apart. She used $\frac{1}{2}$ inch to a foot. Make a drawing to scale showing Marilyn's garden.

What Does It Mean to Measure?

Write an article on one of the following topics:

1. Ancient ways of measuring.
2. Measuring instruments we use today.
3. Workers who use measuring instruments.

Can You Answer These?

1. What does the value 8 ft. 5 in. mean when used for the length of a board?
2. What is the fractional part of a foot when the value is expressed as 8 in.?
3. How do you measure time? What does 6 hr. 26 min. 28 sec. mean?
4. How many feet in 1 yd. 2 ft.? How many inches?
5. How many feet in 1 yd. 9 in.?
6. Name the measuring instruments with which boys might come in contact.
7. Name the measuring instruments with which girls might come in contact.
8. What is the difference between exact and approximate measure?
9. Is counting an exact or an approximate measure?
10. How many inches in 1 yard? $\frac{1}{4}$ yard? $\frac{1}{3}$ yard? $\frac{2}{3}$ yard? $\frac{3}{4}$ yard? $\frac{1}{8}$ yard?
11. The word *standard* has been used on the preceding pages. What does it mean?
12. To what extent is the United States government interested in standards?
13. How many ounces in $5\frac{1}{2}$ pounds?
14. If you bought seven half-pound boxes of candy, how many ounces would you buy?
15. What instruments of measure does a doctor use?
16. What instruments of measure does your mother use?
17. Can you tell what measuring instruments are found on the dashboard of an automobile?
18. Which is larger, 1 inch or $\frac{1}{10}$ of a foot?
19. Which is larger, 1 inch or $\frac{1}{12}$ of a foot?

Test Yourself on Whole Numbers

1. There are 3,220,000 miles of roads and streets in the United States. Only 750,000 miles are paved. How many miles of unpaved road are there?

2. In one large city 2,246 men between the ages of 21 and 30 took police officer examinations. Only 626 men passed the examination. How many failed? There were only 420 vacancies at that time. So, of the original number who took the examination, how many did not get jobs?

3. During the past year in the United States, there were 6,500 drownings. Half of them took place during the months of June, July, and August. Find the average number for each of these summer months.

4. Find the total length of the United States coastline and boundary line. The line along Canada is 3,987 miles, along Mexico it is 2,013 miles, along the Gulf of Mexico it is 1,639 miles, along the Atlantic Ocean it is 1,883 miles, and along the Pacific Ocean it is 1,316 miles.

5. On a television screen there are 30 still pictures, each made up of 200,000 dots, shown each second. How many pictures would pass over the screen in one hour?

6. Italy has a population of 45,706,000; Japan, 80,500,000; Mexico, 23,876,000; Iceland, 138,000. Would all of these countries together have a greater or smaller population than the United States, which has approximately 170,000,000 people?

7. Scientists say that a person moves in his sleep every 15 minutes. How many times did you move last night, assuming that you had 9 hours of sleep?

8. The total number of people who had flown in DC-6 planes equals the total population of these cities:

New York	7,891,957	Johannesburg	912,339
Tokyo	6,277,500	Buenos Aires	3,366,693
Chicago	3,620,962	London	8,346,167
Rome	1,721,855	Sydney	1,610,580

Find the total number of people who have flown in these planes.

Test Yourself on Fundamentals with Whole Numbers

1. Add these columns. Check by adding in the opposite direction:

2	7	3	6	7	6	4	8	9	7	8
6	5	2	9	2	9	7	6	8	5	2
3	2	6	2	3	4	9	5	5	6	7

2. Subtract these numbers. Check by adding:

39	64	49	80	86	75	500	143	806
6	8	14	41	78	8	280	73	507

3. Multiply these numbers:

9	7	18	14	541	51	33	601	65
6	9	7	9	12	13	9	29	32

4. Divide these numbers:

$3\overline{)369}$ $4\overline{)248}$ $7\overline{)287}$ $30\overline{)270}$ $42\overline{)966}$ $65\overline{)4695}$ $26\overline{)18486}$

5. Add these numbers:

90	408	352	6007	6840	7747
30	865	900	8040	2796	2768
50	39	406	8957	3856	9749
70	570	52	2605	4970	3832
60	783	796	4727	3604	9430

6. Subtract these numbers:

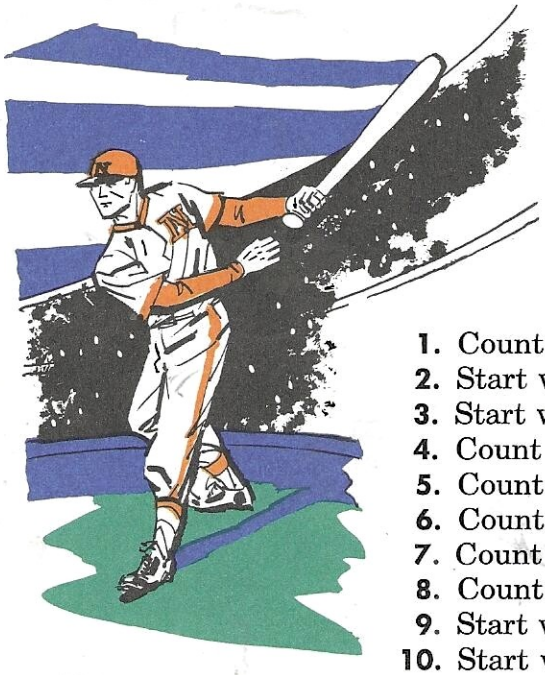
120	370	706	3774	6080	9000	501
90	290	290	1983	4836	247	298

7. Multiply:

130	370	706	2035	7009	4792	5006
90	29	32	601	36	348	297

8. Divide and check:

$40\overline{)9600}$ $201\overline{)3015}$ $400\overline{)12000}$ $504\overline{)34776}$ $76\overline{)2888}$



Practice Exercises

Everyone engaged in sports does some warming up exercises before he goes into his game. He should do the same in mathematics.

Warm up with the exercises on this page.

1. Count to 100 by 10's.
2. Start with 1, and count to 101 by 10's.
3. Start with 5, and count to 95 by 10's.
4. Count to 99 by 2's (start with 1).
5. Count to 99 by 3's (start with 3).
6. Count to 98 by 7's (start with 7).
7. Count to 96 by 8's (start with 8).
8. Count to 99 by 9's (start with 9).
9. Start with 1, and count upward to 100 by 3's.
10. Start with 1, and count upward to 98 by 4's.

Here are some more exercises in addition. Give the answers as quickly as you can.

11.	6	2	8	5	9	3	0
	+8	+5	+7	+4	+2	+8	+8
12.	4	7	6	3	9	5	1
	+6	+6	+9	+4	+1	+3	+4
13.	4	8	7	1	9	5	6
	+7	+3	+9	+6	+4	+0	+7
14.	9	6	0	4	8	5	7
	+3	+4	+9	+5	+6	+6	+5
15.	7	9	6	4	5	9	8
	+5	+9	+0	+8	+9	+6	+5
16.	4	1	9	3	2	1	8
	+4	+0	+9	+9	+3	+7	+2

Continue Your Practice

Give the answers to the following. Do not use pencil and paper.

	Start with:	*Add:*	*Subtract:*	*Multiply:*	*Divide:*	*Answer*
1.	20	15	10	4	5	?
2.	50	20	15	2	5	?
3.	17	6	8	3	9	?
4.	27	13	8	2	16	?
5.	29	29	30	2	7	?
6.	13	26	9	4	10	?
7.	18	36	24	5	15	?
8.	11	39	25	10	5	?
9.	23	13	9	2	6	?
10.	49	7	16	8	4	?
11.	76	24	40	6	10	?
12.	125	15	20	3	6	?
13.	52	13	35	2	7	?
14.	150	75	50	0	8	?
15.	96	14	50	8	12	?

Do what the exercise tells you to do. Do not use pencil and paper.

16.	$38 - 7$	$58 - 32$	$79 - 36$	$256 - 123$	$6849 - 1438$	$95467 - 62351$
17.	50×5	302×4	6050×6	809×5	7000×8	9240×2
	a.	**b.**	**c.**	**d.**		
18.	$)484$	$6)360$	$8)1608$	$7)2177$		
19.	$12)2412$	$9)8199$	$5)5155$	$8)8064$		
20.	$73 + 65 = ?$	$98 + 8 = ?$	$67 + 48 = ?$	$18 + 29 = ?$		
21.	$37 + 17 = ?$	$46 + 26 = ?$	$16 + 47 = ?$	$72 + 61 = ?$		
22.	$46 - 8 = ?$	$78 - 36 = ?$	$47 - 27 = ?$	$83 - 71 = ?$		
23.	$84 - 9 = ?$	$97 - 42 = ?$	$100 - 18 = ?$	$92 - 77 = ?$		
24.	$16 \times 5 = ?$	$19 \times 2 = ?$	$36 \times 3 = ?$	$49 \times 5 = ?$		
25.	$256 \div 4 = ?$	$512 \div 8 = ?$	$1125 \div 5 = ?$	$275 \div 25 = ?$		

Adding and Checking

Add each column down, and *check* by adding the column up. If you get the same answer both ways, your answer is probably correct.

1. 51	**2.** 79	**3.** 11	**4.** 23	**5.** 82
17	44	31	64	76
83	18	62	89	98
6. $.68	**7.** $.85	**8.** $1.22	**9.** $3.29	**10.** $.65
.32	.27	3.01	4.01	.36
.91	.48	.96	8.92	.91
1.10	.96	4.28	5.16	.48
11. 708	**12.** 182	**13.** 461	**14.** $8.19	**15.** $3.14
544	298	693	3.48	2.15
816	406	100	7.13	7.91
902	301	310	9.19	1.16
16. 1896	**17.** 7899	**18.** 7896	**19.** $18.76	**20.** $11.32
4023	2001	4218	42.14	42.19
6941	3849	3002	29.19	13.64
8402	6421	6984	36.02	78.93
21. 59602	**22.** 49309	**23.** 36928	**24.** 86493
46812	31412	42610	21041
36493	62381	38748	38348
42385	48842	59562	90006
25. 94862	**26.** $342.15	**27.** $314.36	**28.** $721.02
86941	862.98	846.98	786.68
29. 698764	**30.** 400986	**31.** $6946.25	**32.** $ 99.75
880659	711287	9762.75	298.46
623587	835469	8497.25	684.59

Large Numbers

Large Numbers of the Future

$15.3 billions will be spent each year for education.

Over one hundred thousand new teachers will be needed.

The number of children in elementary schools will reach 42 millions.

Over 60 million automobiles will be in use in the United States.

Twelve hundred million home freezers will be in use.

Household equipment will cost $16.8 billions.

Can you write the numbers in the above sentences in figures?

These large numbers are seen in every newspaper, and you should be able to read and write them.

Numbers are divided into families of three members each. Each family is separated from the other family by commas.

Family	Billions			Millions			Thousands			Ones		
	4	5	2	6	7	6	2	9	1	3	4	6
Members of the family	hundreds	tens	ones	hundreds	tens	ones	hundreds	tens	ones	hundreds	tens	ones

1. Study the number 26,942,201,906 and then fill in these blanks:

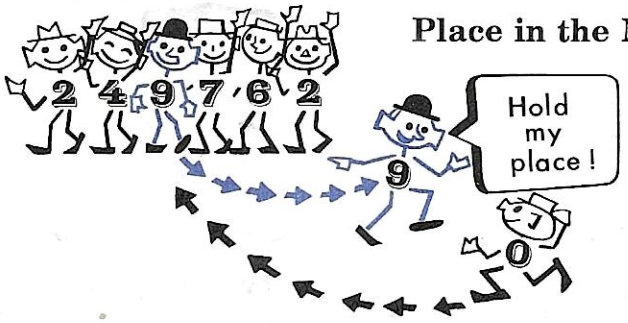
a. The numbers in the ones family are ? .

b. The numbers in the thousands family are ? .

2. Read these numbers:

a. 2,642,901
b. 720,206
c. 31,021,698
d. 400,502,009
e. 2,596,401
f. 6,209,605,001
g. 18,000,210,000
h. 946,000,209
i. 103,692,486,290
j. 8,000,962

Place in the Number System



1. Look at the number 64,872.

a. 2 is in ? place.
b. 7 is in ? place.
c. 8 is in ? place.
d. 4 is in ? place.
e. 6 is in ? place.

2. a. The number 496 is made up of ? hundreds, ? tens, ? ones.

b. The number 64 has ? tens and ? ones.

c. The number 8,962 has ? ? and ? ? and ? ? and ? ? .

d. The number 2,069,421 has ? ? and ? ? and ? ? and ? ? and ? ? and ? ? .

3. Copy and fill in the blanks:

a. 62 = 60 + ? .
b. 723 = 700 + ? + ? .
c. 2,486 = ? + ? + ? + ? .
d. 42,693 = ? + ? + ? + ? .

4. Write the number that would equal the parts given:

a. 300 + 40 + 6 = ? .
b. 5,000 + 800 + 40 = ? .
c. 4,000 + 600 + 30 + 4 = ? .
d. 10,000 + 7,000 + 400 + 82 + 2 = ? .

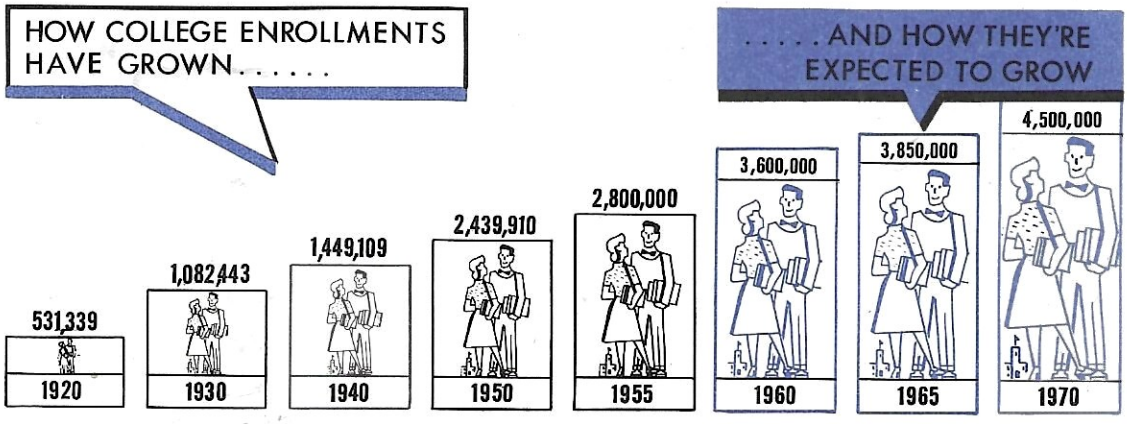
5. The decimal system cannot be written without the zero. Why?

a. Tell what each zero means in this number: 2,406,700,309

b. Write a 7-place number that has no value in the thousands or the ones place.

6. Tell what the 6 means in these numbers:

a. 226	**c.** 2,406,303	**e.** 3,460	**g.** 264,328
b. 6,203	**d.** 6,000,201	**f.** 9,622	**h.** 6,000,209



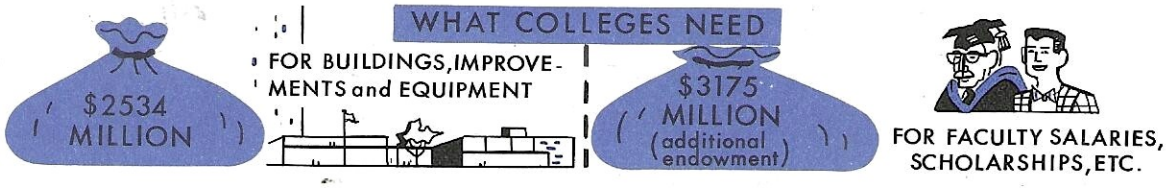
Using Large Numbers

1. Read the number of students who entered college from the year 1920 to the number expected in 1970.

2. Which of these numbers would you say are exact numbers? Why?

3. Which of these numbers would you say are rounded?

4. What is the difference between an exact number and a rounded number?



5. Write in figures the two amounts of money which the colleges need for buildings and salaries. How many places has each of these numbers?

6. Are these numbers exact or rounded numbers?

7. The number 626 rounded to hundreds is 600. Why?

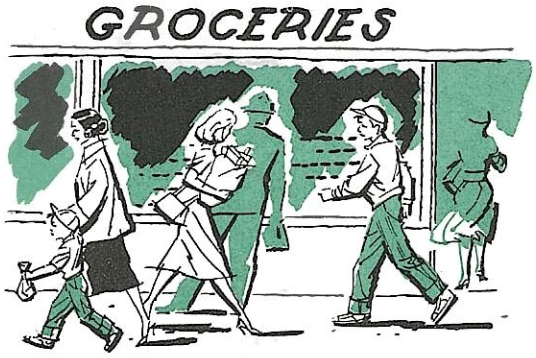
8. The number 687 rounded to hundreds is 700. Why?

9. The number 1,246 rounded to thousands is 1,000. Why?

10. The number 1,640 rounded to thousands is 2,000. Why?

11. Round these numbers first to the nearest thousand, then to the nearest ten thousand.

a. 273,529	**c.** 203,389	**e.** 470,208
b. 635,291	**d.** 499,628	**f.** 259,600



Using Addition

The United States imported $3,330,450,000 worth of food in 1 year. Coffee, tea, cocoa, cheese, and spices head the list, while olives, olive oil, sugar, fish, dates, and garlic are other major items.

1. In the first 3 months of a certain year there were 4,505,450 bags of coffee and 43,750,240 pounds of tea imported.

a. At this same rate, how much of each product would be imported in one year?

b. Round your answers to the nearest million.

2. During these same 3 months there were 67,636 tons of cocoa imported.

a. At this rate, how many tons of cocoa is this in a year?

b. Round your answer to the nearest hundred thousand.

c. How many pounds of cocoa were imported in 3 months? Round your answer to the nearest million.

3. Here is a list of imported spices. Round each number to the nearest million; then, using your rounded numbers, find the total number of pounds of imported spices:

Pepper	37,342,700 lb.	Poppy seed	7,900,000 lb.
Mustard	22,750,000 lb.	Caraway seed	6,276,400 lb.
Cinnamon	10,950,600 lb.	Nutmeg	4,590,000 lb.
Paprika	8,220,650 lb.		

4. Italy sent 17,226,425 lb. of cheese to the United States in 1 year. Switzerland sent 10,000,425 lb., Denmark 4,650,700 lb., France 2,765,000 lb., and Argentina 1,890,280 lb.

Round these numbers to the nearest million, and then find the total number of pounds of imported cheese.

Subtracting and Checking

1. Place a paper under these problems and subtract:

a. 8976 − 4231	**b.** 9548 − 2103	**c.** 86495 − 62103	**d.** 209875 − 108354

2. Now add your answers to the bottom row of figures. If your new answer is the same as the top row, your answers to the subtractions were correct. This is the way to check a subtraction.

593 → minuend − 281 → subtrahend 312 → difference	Check: difference + subtrahend = minuend

3. Subtract and check:

a. 974 − 705	**b.** 795 − 568	**c.** 703 − 294	**d.** 9062 − 4327	**e.** 9162 − 4295
f. 506 − 238	**g.** 236 − 176	**h.** 235 − 187	**i.** 2882 − 694	**j.** 4602 − 3672
k. 762 − 580	**l.** 5205 − 3496	**m.** 2985 − 2093	**n.** 2053 − 976	**o.** 6173 − 2895
p. 35063 − 17095	**q.** 85109 − 20838	**r.** 60921 − 24879	**s.** 28048 − 19469	**t.** 3602 − 594

4. Write these examples in column form. Subtract and check.

a. From 98,076 take 28,461.
b. 17,462 less 942
c. 89,746 − 24,839
d. Take 9,864 from 10,000.
e. 6,946 − 5,958
f. Take 3,596 from 5,000.
g. From 100,000 take 86,492.
h. 7,985 is ? less than 8,642.
i. 40,000 minus 8,956
j. What is the difference between 18,956 and 11,492?

Multiplication of Whole Numbers

While Peg and Alice were waiting to be assigned to their new classes, they decided to find the number of seats there were in the auditorium. Peg counted the number of rows (24), and Alice counted the number of seats in each row (46).

Peg multiplied:

$$\begin{array}{r} 46 \\ \times\ 24 \\ \hline 184 \\ 92 \\ \hline 1104 \end{array}$$

Alice multiplied:

$$\begin{array}{r} 24 \\ \times\ 46 \\ \hline 144 \\ 96 \\ \hline 1104 \end{array}$$

They got the answer 1104. Was Alice's work a check on Peg's answer? Why?

Problem:	Check:
82 ← multiplicand	45 ← multiplicand
45 ← multiplier	82 ← multiplier
410 ↘ partial products	90 ↘ partial products
328 ↗	360 ↗
3690 ← product	3690 ← product

Multiply and check these exercises:

1. a. 73 × 62	**b.** 42 × 36	**c.** 920 × 18	**d.** 646 × 92	**e.** 850 × 90
2. a. 496 × 251	**b.** 815 × 362	**c.** 496 × 201	**d.** 597 × 499	**e.** 786 × 493
3. a. 2496 × 82	**b.** 8798 × 96	**c.** 9428 × 39	**d.** 4080 × 57	**e.** 6009 × 76
4. a. 5096 × 386	**b.** 4934 × 257	**c.** 8209 × 948	**d.** 9640 × 979	**e.** 6597 × 659
5. a. 6847 × 90	**b.** 2487 × 800	**c.** 6090 × 300	**d.** 4002 × 809	**e.** 500 × 500
6. a. 74628 × 809	**b.** 28973 × 915	**c.** 28743 × 250	**d.** 86429 × 876	**e.** 7325 × 42

Dividing and Checking Whole Numbers

At the first meeting of the Student Council Terry Miller gave his report on duties in the lunchroom. There were:

180 days in the coming term and
29 classes in the school.

Therefore each class will have duty for 6 days this year and the remaining 6 days will be taken care of by volunteer help.

This is how Terry got his report:

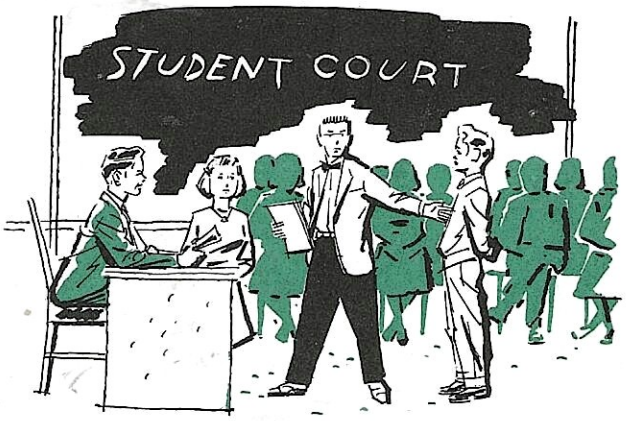
$$\begin{array}{r} 6 \leftarrow \text{quotient} \\ 29\overline{)180} \leftarrow \text{dividend} \\ \nearrow\ \underline{174} \\ \text{divisor} \quad 6 \leftarrow \text{remainder} \end{array}$$

Check by multiplication:

$$\begin{array}{r} 6 \leftarrow \text{quotient} \\ \times\ 29 \leftarrow \text{divisor} \\ \hline 174 \\ +\ 6 \leftarrow \text{remainder} \\ \hline 180 \leftarrow \text{dividend} \end{array}$$

Divide and check the following problems:

1.	**a.** $9\overline{)1809}$	**b.** $7\overline{)2870}$	**c.** $8\overline{)2728}$	**d.** $6\overline{)19206}$
2.	**a.** $24\overline{)264}$	**b.** $12\overline{)252}$	**c.** $64\overline{)960}$	**d.** $56\overline{)4200}$
3.	**a.** $17\overline{)2176}$	**b.** $87\overline{)8178}$	**c.** $37\overline{)3774}$	**d.** $29\overline{)2581}$
4.	**a.** $85\overline{)20145}$	**b.** $72\overline{)23112}$	**c.** $68\overline{)34000}$	**d.** $13\overline{)9048}$
5.	**a.** $156\overline{)34164}$	**b.** $208\overline{)107328}$	**c.** $312\overline{)214032}$	
6.	**a.** $618\overline{)339900}$	**b.** $325\overline{)264550}$	**c.** $568\overline{)231744}$	
7.	**a.** $54\overline{)35070}$	**b.** $97\overline{)35308}$	**c.** $846\overline{)126937}$	
8.	**a.** $457\overline{)132570}$	**b.** $809\overline{)218154}$	**c.** $689\overline{)409268}$	
9.	**a.** $97\overline{)35308}$	**b.** $908\overline{)410512}$	**c.** $237\overline{)142915}$	



Finding Averages

1. During the school year the student court of the Parkside School held 24 meetings. The following cases were tried:

Disobeying traffic rules	85
Whistling in halls	7
Leaving paper on floor	18
Chewing gum	9
Talking in Fire Drill	23

a. What was the average number of cases tried at each meeting?

b. To find the average, you ? the number of cases by the number of meetings held.

The average number tried at each meeting was ? .

2. A weekly magazine advertised these rates:

1 year	$ 6.00
2 years	$10.00
3 years	$14.00
4 years	$18.00

Find the average price per copy of each type of subscription.

3. The Springside School collected $742.50 for the Red Cross and $597.75 for the Community Chest. There were 1,552 pupils in the school. What was the average contribution of each pupil (to the nearest cent)?

4. One store had soap advertised at a dozen bars for $1.29. Another store had the same brand advertised as 3 for $.34. Which was the better buy?

5. Jane and her sister travel 1,586 miles to their grandmother's home each summer. This summer the train trip going took 26 hours and the return trip took 25 hours. What was the average number of miles the train traveled per hour?

6. Find the average for each of the following groups:

a. 23, 37, 26, 65
b. 82, 78, 47, 52
c. 68, 64, 54, 92
d. 183, 257, 301, 412
e. 262, 319, 293, 246
f. 516, 502, 536, 540

No Pencil or Paper

Sometimes you must do some problems in arithmetic without using pencil and paper. For this you need an alert mind, not a lazy one. It is easy to add, subtract, or multiply numbers if you follow some plan. Here are a few suggestions:

1. Add $54 + 68$:

a. $50 + 60 = 110$
$4 + 8 = 12$
$110 + 12 = 122$

b. $54 + 70 = 124$
$70 - 68 = 2$
$124 - 2 = 122$

c. $54 + 60 = 114$
$114 + 8 = 122$

2. Use your own plan, and tell how you would add these numbers. Give the answers:

a. $76 + 37$	**d.** $79 + 37$	**g.** $256 + 158$	**j.** $412 + 517$
b. $18 + 49$	**e.** $85 + 96$	**h.** $175 + 215$	**k.** $290 + 415$
c. $36 + 68$	**f.** $48 + 77$	**i.** $342 + 348$	**l.** $1250 + 1027$

3. Subtract $87 - 38$:

a. $87 - 37 = 50$
$50 - 1 = 49$

b. $87 - 30 = 57$
$57 - 8 = 49$

c. $90 - 38 = 52$
$52 - 3 = 49$

4. Use your own plan, and tell how you would subtract these numbers. Give the answers:

a. $56 - 28$	**d.** $220 - 26$	**g.** $200 - 86$	**j.** $1800 - 750$
b. $48 - 29$	**e.** $542 - 36$	**h.** $1000 - 890$	**k.** $4200 - 450$
c. $94 - 36$	**f.** $173 - 49$	**i.** $5000 - 438$	**l.** $3650 - 750$

5. Multiply 11×18:

Say to yourself: $10 \times 18 = 180$
$1 \times 18 = 18$
Therefore, $11 \times 18 = 180 + 18 = 198$

$136 \times 8 =$ $\begin{cases} 100 \times 8 = 800 \\ 30 \times 8 = 240 \\ 6 \times 8 = 48 \end{cases}$ $800 + 240 + 48 = 1088$

6. Find these answers orally:

a. 13×9	**c.** 34×12	**e.** 125×4	**g.** 350×5
b. 9×43	**d.** 7×82	**f.** 136×3	**h.** 620×8

The School Lunchroom

Menu For Tuesday			
Soup	.10	Pie	.08
Special Platter	.25	Cake	.10
Sandwiches	.12	Ice Cream	.10
Hot Sandwiches	.20	Milk	.06
Salads	.15	Orange Drink	.08
Roll	.04	Cookies 3 for	.05
Butter	.02	Peanut Bar	.02

Jack had 30 cents to spend for lunch on Tuesday. He ordered soup, sandwich, and pie. Did he have any money left?

When you eat in a restaurant or a cafeteria, you have to do some mental arithmetic.

In these problems you are given the amount of money each student had for lunch and what he or she bought. Tell the cost of each lunch and how much each one had left. *Do not use pencil and paper.*

1. Tom (42¢) — special platter, milk, ice cream.

2. Bill (30¢) — hot sandwich, milk.

3. Martha (45¢) — salad, milk, roll, butter, ice cream.

4. Jack (40¢) — sandwich, milk, ice cream, 6 cookies.

5. Betty (50¢) — special platter, milk, roll, butter, ice cream.

6. Sandra (45¢) — hot sandwich, orange drink, 3 cookies.

7. Henry (38¢) — 2 sandwiches, pie, 3 cookies.

8. Jim (28¢) — soup, sandwich, 3 cookies.

9. Mary (32¢) — special platter, roll, butter.

10. Carl (34¢) — soup, salad, roll, butter.

11. Larry (46¢) — special platter, pie, ice cream.

12. Donald (30¢) — hot sandwich, milk, peanut bar.

13. Irene (25¢) — cake, ice cream, 2 peanut bars.

14. Louise (35¢) — salad, roll, butter, orange drink, 3 cookies.

15. Marvin (40¢) — hot sandwich, pie, ice cream, peanut bar.

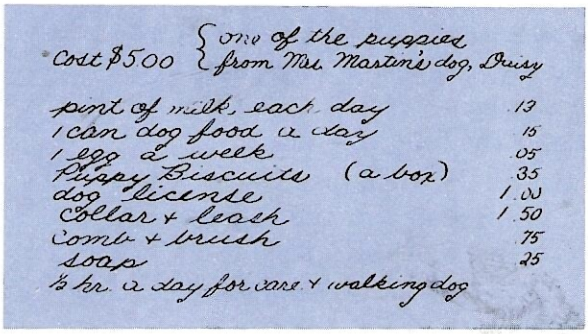
16. How many platters were sold? Total cost = ? .

17. How many hot sandwiches were sold? Total cost = ? .

18. If Bill, Mary, and Marvin spent the same amount each school day, how much did it cost each one per week?

Jane's Dog, Merry

Before Jane got her dog, Merry, she went to her mother with an estimate of what the dog would cost in time and money. Here is the list that Jane gave her mother.



Cost $5.00 { one of the puppies from Mrs. Martin's dog, Daisy	
pint of milk each day	.13
1 can dog food a day	.15
1 egg a week	.05
Puppy Biscuits (a box)	.35
dog license	1.00
Collar + leash	1.50
comb + brush	.75
soap	.25
½ hr. a day for care + walking dog	

This list that Jane made contained only approximate numbers. The exact amounts were not necessary. Why? Is there any exact number in the list?

1. What would be the approximate cost for the dog if food is not included?

2. The dog food could be bought at 3 cans for $.45. What would a 30-day supply cost?

3. Jane bought the milk by the quart. How many quarts would the dog use in 30 days? How much did the milk cost at 27 cents a quart?

4. The eggs were bought by the dozen at 65 cents a dozen. Approximately how many dozen would the dog eat in a year? What would be the approximate cost of the eggs?

5. How much of Jane's time would be used for the care of the dog in one year?

6. Jane learned there were other expenses for Merry. Three inoculations for distemper and one for rabies required a visit to the veterinarian 4 times in the year. This cost $2.50 a visit and $1.00 for each inoculation. How much was the doctor's bill for the year?

7. One box of puppy biscuits lasted about 2 weeks. At $.35 a box how much did Jane pay for biscuits in a year?

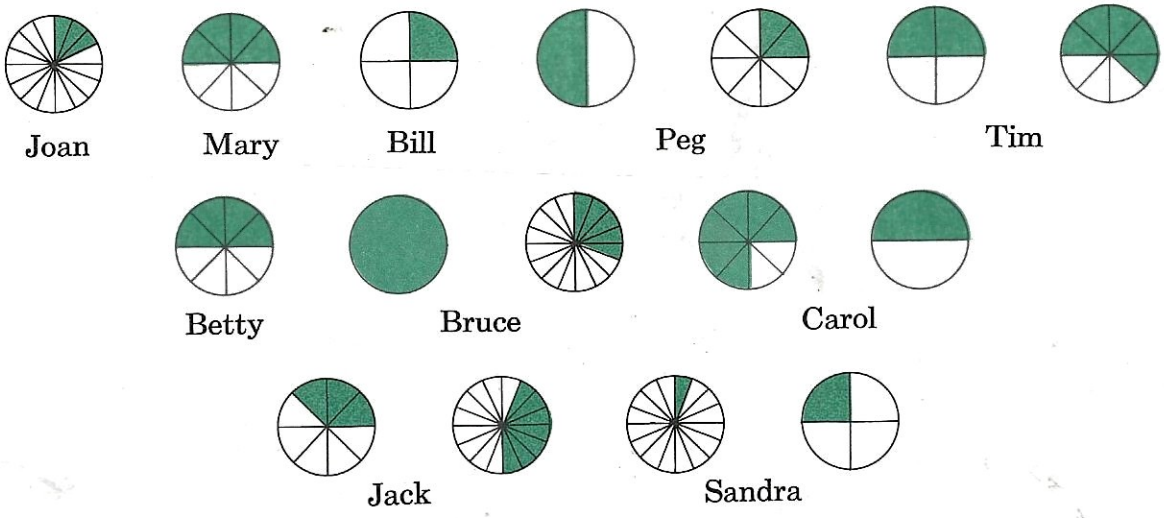
Using Fractions

The Breeze was a magazine published by the students of the Seaside School. Advertising was sold to help cover the cost. Advertising space was sold by the whole page, half, quarter, eighth, and sixteenth of a page.

The members of the Ad Club sold the following ads:

Joan: 3 of the $\frac{1}{16}$ page
Mary: 4 of the $\frac{1}{8}$ page
Bill: 1 of the $\frac{1}{4}$ page
Peg: 1 of the $\frac{1}{2}$ page and 2 of the $\frac{1}{8}$ page
Tim: 2 of the $\frac{1}{4}$ page and 5 of the $\frac{1}{8}$ page
Betty: 4 of the $\frac{1}{8}$ page
Bruce: 1 whole page and 5 of the $\frac{1}{16}$ page
Carol: 6 of the $\frac{1}{8}$ page and 1 of the $\frac{1}{2}$ page
Jack: 3 of the $\frac{1}{8}$ page and 7 of the $\frac{1}{16}$ page
Sandra: 1 of the $\frac{1}{16}$ page and 1 of the $\frac{1}{4}$ page

You can show what each student sold by using circles and parts of circles. Explain how the shaded parts represent the figures given above:



Meaning of Fractions

1. How many pages of the $\frac{1}{16}$ page advertisements were sold?

2. How many pages of the $\frac{1}{8}$ page advertisements were sold?

3. How many pages of the $\frac{1}{4}$ page advertisements were sold?

4. How many pages of the $\frac{1}{2}$ page advertisements were sold?

5. How many pages of advertisements were sold altogether?

6. You can say that Peg sold $\frac{2}{8}$ or $\frac{1}{4}$ page. Why?

7. Betty sold $\frac{4}{8}$ page which is $\frac{1}{2}$ page. Why?

8. Name some other fractions that are the same as $\frac{1}{2}$.

9. What would you do to the fraction $\frac{8}{16}$ to make it equal $\frac{1}{2}$?

10. The top number of a fraction is called the ? .

11. The bottom number of a fraction is called the ? .

12. $\frac{4}{16}$ can be changed to $\frac{1}{4}$ by ? both the ? and the ? by ? .

13. $\frac{1}{8}$ can be changed to $\frac{2}{16}$ by ? both the ? and the ? by ? .

14. Fill in the question marks in these fractions:

a. $\frac{7}{8} = \frac{?}{32}$	**e.** $\frac{1}{3} = \frac{9}{?}$	**i.** $\frac{4}{5} = \frac{?}{30}$
b. $\frac{5}{8} = \frac{?}{16}$	**f.** $\frac{3}{8} = \frac{?}{24}$	**j.** $\frac{7}{9} = \frac{21}{?}$
c. $\frac{5}{8} = \frac{15}{?}$	**g.** $\frac{9}{10} = \frac{?}{100}$	**k.** $\frac{3}{5} = \frac{?}{60}$
d. $\frac{3}{10} = \frac{?}{30}$	**h.** $\frac{2}{3} = \frac{8}{?}$	**l.** $\frac{3}{10} = \frac{36}{?}$

15. Fill in the question marks in these fractions:

a. $\frac{8}{16} = \frac{?}{2}$	**e.** $\frac{9}{36} = \frac{?}{12}$	**i.** $\frac{15}{18} = \frac{5}{?}$
b. $\frac{6}{9} = \frac{?}{3}$	**f.** $\frac{14}{16} = \frac{7}{?}$	**j.** $\frac{39}{91} = \frac{3}{?}$
c. $\frac{12}{32} = \frac{?}{8}$	**g.** $\frac{15}{24} = \frac{?}{8}$	**k.** $\frac{28}{42} = \frac{4}{?}$
d. $\frac{20}{25} = \frac{4}{?}$	**h.** $\frac{30}{35} = \frac{?}{7}$	**l.** $\frac{16}{80} = \frac{?}{5}$

16. Tell why $\frac{5}{6}$ is a proper fraction; $\frac{9}{7}$ is an improper fraction; $3\frac{1}{2}$ is a mixed number.

17. Explain the meaning of proper and improper fractions and mixed numbers.

Test Yourself on Fractions

1. Don and Bill spent one of their vacation weeks taking trips on their bicycles. On Monday they rode $4\frac{1}{2}$ miles, Tuesday $5\frac{1}{2}$ miles, Wednesday $4\frac{3}{4}$ miles, Thursday $6\frac{1}{8}$ miles, Friday $3\frac{7}{8}$ miles, and Saturday $7\frac{1}{4}$ miles. Find their total mileage.

2. What was the boys' average mileage per day?

3. The distance between Don's town of Castorville and his cousin's town of Lawnview is $24\frac{3}{4}$ miles. If a neighbor drove Don $\frac{2}{3}$ of the way, how far did Don have to hike to his cousin's town?

4. Mrs. Wear's meat for the weekend weighed $7\frac{3}{4}$ lbs. At 85 cents per pound, how much did the meat cost?

5. Donald earned $53.00 during his summer vacation of $2\frac{1}{2}$ months. If he could continue earning at this same rate, how much would he earn in the entire year?

6. A sign at the candy store said 26¢ for $\frac{1}{4}$ lb. How much would this be a pound?

7. A salesgirl noticed that a new bolt of cloth that had just come in contained $36\frac{1}{4}$ yards. If her sales the first day were $2\frac{1}{2}$ yards, $4\frac{3}{4}$ yards, $2\frac{1}{2}$ yards, $6\frac{1}{4}$ yards, and $4\frac{7}{8}$ yards, how many yards were left in the bolt at the end of the day?

8. Some cards were being sold at 96 cents a dozen. How much would 2 cards cost?

9. Each week Mr. Wear divided $10.00 among his 4 children. To the oldest boy he gave $\frac{1}{2}$, to the oldest girl $\frac{1}{4}$, and to the 2 younger children $\frac{1}{8}$ each. How much did each child receive?

10. Florence bought $1\frac{3}{4}$ yards of woolen material for $7.35. How much did she pay per yard?

11. Hardwood flooring comes in strips $1\frac{1}{4}$ inches wide. How many strips would be needed to cover a floor 12 feet wide?

12. This is a recipe for chocolate icing. Change it to make only half the amount. Change it to make twice the amount.

$1\frac{1}{2}$ tbsp. butter $1\frac{1}{4}$ cups sugar
$\frac{1}{3}$ cup cocoa $\frac{1}{4}$ cup milk
$\frac{1}{2}$ tsp. vanilla

Practice in Fundamentals with Fractions

1. Add:

a.	b.	c.	d.	e.	f.
$\frac{2}{5}+\frac{2}{5}$	$\frac{3}{4}+\frac{3}{4}$	$\frac{3}{5}+\frac{4}{5}$	$\frac{3}{16}+\frac{3}{4}$	$2\frac{3}{8}+\frac{1}{8}$	$6\frac{1}{4}+7\frac{3}{4}$
$\frac{3}{4}+\frac{1}{4}$	$\frac{1}{3}+\frac{3}{3}$	$\frac{1}{6}+\frac{1}{3}$	$\frac{5}{6}+\frac{1}{2}$	$1\frac{2}{5}+\frac{1}{10}$	$1\frac{2}{3}+2\frac{1}{6}$
$\frac{9}{10}+\frac{3}{10}$	$\frac{1}{2}+\frac{1}{4}$	$\frac{3}{4}+\frac{1}{12}$	$\frac{2}{3}+\frac{3}{4}$	$1\frac{1}{4}+1\frac{7}{8}$	$3\frac{3}{5}+6\frac{7}{10}$

2. Subtract:

a.	b.	c.	d.	e.	f.
$\frac{2}{3}-\frac{1}{3}$	$2-\frac{1}{2}$	$2\frac{3}{4}-\frac{1}{4}$	$3\frac{1}{4}-\frac{2}{3}$	$16-1\frac{1}{4}$	$12\frac{1}{2}-7\frac{1}{3}$
$\frac{1}{4}-\frac{1}{8}$	$\frac{3}{8}-\frac{1}{4}$	$1\frac{7}{12}-\frac{2}{3}$	$8\frac{7}{8}-6\frac{3}{4}$	$12\frac{1}{4}-9\frac{1}{3}$	$6\frac{5}{8}-3\frac{1}{4}$
$\frac{15}{16}-\frac{1}{8}$	$1-\frac{1}{4}$	$7\frac{5}{8}-\frac{7}{8}$	$7\frac{2}{5}-3$	$1\frac{5}{8}-\frac{1}{4}$	$8-6\frac{2}{3}$

3. Multiply:

a.	b.	c.	d.	e.	f.
$9\times\frac{2}{3}$	$\frac{4}{5}\times\frac{7}{16}$	$10\times\frac{1}{4}$	$6\times\frac{1}{4}$	$\frac{3}{4}\times 22$	$4\frac{1}{2}\times 2\frac{1}{2}$
$\frac{3}{4}\times 20$	$4\times 6\frac{1}{2}$	$\frac{4}{5}\times 100$	$\frac{3}{8}\times\frac{5}{6}$	$\frac{7}{8}\times 17$	$4\frac{2}{3}\times 3\frac{1}{4}$
$\frac{2}{3}\times\frac{5}{8}$	$\frac{2}{3}\times\frac{3}{4}$	$4\frac{1}{2}\times\frac{5}{8}$	$\frac{1}{4}\times\frac{4}{5}$	$\frac{9}{10}\times 75$	$2\frac{3}{5}\times 2\frac{2}{3}$

4. Divide:

a.	b.	c.	d.	e.	f.
$30\div\frac{2}{3}$	$\frac{1}{2}\div 4$	$6\frac{1}{2}\div\frac{2}{3}$	$5\div 1\frac{1}{4}$	$7\frac{1}{2}\div 2\frac{1}{2}$	$6\frac{1}{4}\div 4\frac{1}{6}$
$24\div\frac{3}{4}$	$\frac{3}{4}\div 6$	$7\frac{3}{4}\div\frac{1}{2}$	$18\div 2\frac{2}{3}$	$6\frac{2}{3}\div 1\frac{2}{3}$	$4\frac{1}{2}\div 5\frac{1}{4}$
$10\div\frac{1}{2}$	$\frac{7}{8}\div 9$	$8\frac{1}{8}\div\frac{4}{5}$	$25\div 2\frac{3}{5}$	$1\frac{1}{6}\div 1\frac{5}{9}$	$4\frac{1}{2}\div 1\frac{11}{16}$

5. Add:

a.	b.	c.	d.
$1\frac{2}{3}$	$2\frac{1}{3}$	$5\frac{1}{2}$	$6\frac{2}{3}$
$2\frac{5}{6}$	$3\frac{2}{5}$	$3\frac{5}{8}$	$2\frac{1}{2}$
$1\frac{8}{9}$	$1\frac{3}{10}$	$2\frac{1}{6}$	$8\frac{5}{6}$

6. Subtract:

a.	b.	c.	d.
$7\frac{5}{16}$	$7\frac{1}{4}$	$5\frac{3}{4}$	$38\frac{2}{9}$
$4\frac{3}{8}$	$6\frac{7}{8}$	$2\frac{9}{10}$	25

7. Multiply:

a.	b.	c.
$4\frac{1}{2}\times 5\frac{1}{5}$	$7\frac{1}{3}\times 2\frac{1}{4}$	$7\frac{1}{4}\times 5\frac{1}{16}$

8. Divide:

a.	b.	c.
$11\div\frac{2}{3}$	$6\frac{4}{5}\div 2\frac{1}{8}$	$16\div 4\frac{1}{5}$

9. Do what the sign tells you to do:

a. $4\frac{3}{16}-2\frac{1}{2}$
b. $\frac{3}{5}+\frac{1}{4}+\frac{1}{2}+\frac{3}{4}$
c. $\frac{15}{16}\times\frac{2}{3}$
d. $1\frac{1}{4}+1\frac{5}{8}+1\frac{2}{12}$
e. $\frac{3}{4}\times 900$
f. $5\frac{3}{4}-2\frac{9}{10}$
g. $7\div 5\frac{1}{2}$
h. $\frac{3}{10}+\frac{1}{2}+2\frac{3}{4}$
i. $5\frac{1}{3}\div 4$
j. $5\frac{1}{4}+2\frac{5}{8}+6\frac{1}{4}+1\frac{7}{12}$
k. $4\frac{5}{12}-\frac{5}{6}$
l. $26\div\frac{2}{3}$
m. $500\times 2\frac{1}{5}$
n. $2\frac{2}{3}\times 1\frac{2}{3}$
o. $\frac{5}{6}\times\frac{2}{3}\times\frac{1}{3}$

Using the Vocabulary of Fractions

1. $\frac{1}{3} = \frac{2}{6} = \frac{4}{12} = \frac{8}{24}$. These fractions are called **equivalent fractions.** Why?

2. $\frac{15}{20} = \frac{3}{4}$. The fraction $\frac{15}{20}$ has been changed to **lowest terms.** How?

3. $\frac{19}{3}$ is an **improper fraction.** It can be changed to the mixed number $6\frac{1}{3}$. How can this be done?

4. $2\frac{5}{6}$ is a **mixed number** and can be changed to the improper fraction $\frac{17}{6}$. This can be done by ? 2 by 6, ? the 5 to the product, and ? .

5. The fractions $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$ can be changed to the fractions $\frac{6}{12}$, $\frac{8}{12}$, $\frac{9}{12}$. Why? When you do this, you have found the **lowest common denominator.** Why is 12 the lowest common denominator? Why is it called common?

6. Choose pairs of equivalent fractions in the following:

a. $\frac{1}{2}$ $\frac{3}{8}$ $\frac{5}{10}$ $\frac{12}{32}$

b. $\frac{3}{10}$ $\frac{1}{2}$ $\frac{6}{20}$ $\frac{18}{36}$

c. $\frac{2}{3}$ $\frac{4}{6}$ $\frac{5}{6}$ $\frac{7}{8}$ $\frac{15}{18}$

d. $\frac{10}{11}$ $\frac{8}{9}$ $\frac{6}{7}$ $\frac{16}{18}$ $\frac{24}{27}$

7. Reduce these fractions to lowest terms:

$\frac{12}{48}$ $\frac{18}{36}$ $\frac{12}{16}$ $\frac{9}{45}$ $\frac{7}{42}$ $\frac{13}{39}$ $\frac{21}{24}$ $\frac{19}{38}$ $\frac{17}{51}$

8. Change these improper fractions to whole or mixed numbers:

$\frac{15}{4}$ $\frac{35}{9}$ $\frac{11}{3}$ $\frac{47}{9}$ $\frac{19}{2}$ $\frac{49}{15}$ $\frac{23}{15}$ $\frac{33}{3}$ $\frac{79}{12}$ $\frac{84}{7}$

9. Change these mixed numbers to improper fractions:

$2\frac{5}{6}$ $9\frac{1}{2}$ $3\frac{4}{5}$ $10\frac{1}{3}$ $14\frac{1}{2}$ $16\frac{2}{3}$ $13\frac{1}{5}$

10. Change the fractions in each group to the lowest common denominator:

a. $\frac{1}{2}$ $\frac{1}{6}$ $\frac{2}{3}$

b. $\frac{1}{4}$ $\frac{7}{8}$ $\frac{5}{6}$

c. $\frac{1}{10}$ $\frac{1}{5}$ $\frac{1}{4}$

d. $\frac{3}{4}$ $\frac{10}{12}$ $\frac{5}{6}$

e. $\frac{8}{9}$ $\frac{5}{6}$ $\frac{2}{3}$

f. $\frac{1}{2}$ $\frac{4}{5}$ $\frac{2}{10}$

g. $\frac{2}{5}$ $\frac{3}{4}$ $\frac{3}{8}$ $\frac{3}{20}$

h. $\frac{2}{3}$ $\frac{3}{4}$ $\frac{7}{12}$ $\frac{11}{24}$

i. $\frac{13}{15}$ $\frac{7}{10}$ $\frac{5}{6}$ $\frac{3}{5}$

Addition of Fractions and Mixed Numbers

You can add fractions only when they have the same denominators. Why?

$$\begin{array}{r} \frac{7}{10} \\ +\ \frac{4}{10} \\ \hline \frac{11}{10} = 1\frac{1}{10} \end{array} \qquad \begin{array}{r} 2\frac{1}{2} = 2\frac{4}{8} \\ +\ 3\frac{1}{8} = 3\frac{1}{8} \\ \hline 5\frac{5}{8} \end{array} \qquad \begin{array}{r} 3\frac{4}{5} \\ +\ 2\frac{3}{5} \\ \hline 5\frac{7}{5} = 6\frac{2}{5} \end{array} \qquad \begin{array}{r} 5\frac{1}{4} = 5\frac{3}{12} \\ +\ 2\frac{2}{3} = 2\frac{8}{12} \\ \hline 7\frac{11}{12} \end{array}$$

Explain how each of the above answers was found.

Add the following:

1. a. $7\frac{5}{12} + 2\frac{11}{12}$ **b.** $3\frac{5}{6} + 4\frac{3}{6}$ **c.** $10\frac{5}{16} + 8\frac{3}{16}$ **d.** $6\frac{2}{3} + 4\frac{1}{3}$ **e.** $6\frac{3}{5} + 5\frac{2}{5}$

2. a. $6\frac{1}{4} + 2\frac{7}{8}$ **b.** $18\frac{5}{8} + 3\frac{1}{2}$ **c.** $17\frac{5}{6} + 13\frac{2}{3}$ **d.** $22\frac{7}{9} + 16\frac{2}{3}$ **e.** $25\frac{4}{5} + 17\frac{3}{10}$

3. a. $16\frac{5}{6} + 13\frac{1}{4}$ **b.** $12\frac{7}{10} + 3\frac{3}{4}$ **c.** $7\frac{4}{5} + 3\frac{5}{7}$ **d.** $18\frac{1}{9} + 22\frac{1}{6}$ **e.** $19\frac{5}{6} + 16\frac{4}{5}$

4. a. $\frac{3}{4} + \frac{1}{6} + \frac{1}{2}$ **b.** $1\frac{3}{10} + 4\frac{5}{6} + 8\frac{2}{5}$ **c.** $3\frac{1}{6} + 2\frac{7}{12} + 1\frac{5}{8}$ **d.** $5\frac{2}{3} + 2\frac{1}{6} + 5\frac{3}{4}$ **e.** $14\frac{3}{10} + 12\frac{1}{5} + 11\frac{1}{4}$

5. a. $16\frac{1}{2} + 12\frac{1}{3} + 3\frac{1}{4} + 4\frac{1}{6}$ **b.** $5\frac{1}{2} + 7\frac{2}{5} + 3\frac{3}{10} + 8\frac{1}{4}$ **c.** $11\frac{3}{4} + 2\frac{1}{2} + 5\frac{5}{6} + 8\frac{7}{12}$ **d.** $12\frac{5}{8} + 21\frac{3}{4} + 16\frac{5}{6} + 19\frac{1}{12}$ **e.** $4\frac{3}{10} + 15\frac{1}{5} + 12\frac{1}{4} + 26\frac{5}{8}$

6. a. $3\frac{3}{4} + 2\frac{1}{2} + 6\frac{5}{8} + 1\frac{1}{16}$ **b.** $18\frac{9}{16} + 20\frac{3}{4} + 13\frac{1}{8} + 12\frac{1}{24}$ **c.** $8\frac{5}{6} + 3\frac{1}{2} + 2\frac{3}{4} + 9\frac{7}{9}$ **d.** $7\frac{5}{8} + 2\frac{9}{16} + 26\frac{3}{4} + 29\frac{5}{6}$ **e.** $13\frac{7}{9} + 22\frac{2}{3} + 6\frac{1}{6} + 17\frac{5}{12}$

Subtraction of Fractions and Mixed Numbers

Here are some subtraction examples. Can you tell how each answer was found?

$$\begin{array}{r} 14\frac{3}{8} \\ -\ 2\frac{1}{8} \\ \hline 12\frac{2}{8} \end{array} = 12\frac{1}{4} \qquad \begin{array}{r} 19\frac{3}{8} \\ -\ 3 \\ \hline 16\frac{3}{8} \end{array} \qquad \begin{array}{r} 26\frac{1}{3} \\ -\ 15\frac{1}{4} \\ \hline \end{array} = \begin{array}{r} 26\frac{4}{12} \\ 15\frac{3}{12} \\ \hline 11\frac{1}{12} \end{array} \qquad \begin{array}{r} 18\frac{1}{4} \\ -\ 7\frac{2}{3} \\ \hline \end{array} = \begin{array}{r} 18\frac{3}{12} \\ 7\frac{8}{12} \\ \hline \end{array} = \begin{array}{r} 17\frac{15}{12} \\ 7\frac{8}{12} \\ \hline 10\frac{7}{12} \end{array}$$

When you subtract fractions, you must make sure that the ? are alike.

Do the following subtraction exercises:

1. $\frac{1}{2} - \frac{1}{5}$ $\quad \frac{1}{3} - \frac{1}{8}$ $\quad \frac{1}{3} - \frac{1}{4}$ $\quad \frac{1}{3} - \frac{1}{9}$ $\quad \frac{1}{7} - \frac{1}{8}$

2. $\frac{3}{6} - \frac{1}{4}$ $\quad \frac{1}{2} - \frac{1}{3}$ $\quad \frac{1}{2} - \frac{1}{10}$ $\quad \frac{1}{3} - \frac{1}{8}$ $\quad \frac{1}{9} - \frac{1}{12}$

3. **a.** $1\frac{1}{4} - 1\frac{1}{5}$ $\quad$ **b.** $5\frac{1}{4} - 3\frac{1}{6}$ $\quad$ **c.** $8\frac{1}{6} - 5\frac{1}{8}$ $\quad$ **d.** $9\frac{5}{12} - 7\frac{3}{8}$ $\quad$ **e.** $2\frac{5}{6} - 1\frac{2}{9}$

4. **a.** $9\frac{3}{8} - 7\frac{1}{4}$ $\quad$ **b.** $5\frac{2}{3} - 2\frac{2}{9}$ $\quad$ **c.** $8\frac{3}{10} - 2\frac{3}{4}$ $\quad$ **d.** $7\frac{1}{8} - 3\frac{1}{3}$ $\quad$ **e.** $5\frac{1}{3} - 4\frac{3}{4}$

5. **a.** $16\frac{1}{12} - 7\frac{3}{4}$ $\quad$ **b.** $23\frac{1}{2} - 5\frac{7}{10}$ $\quad$ **c.** $26\frac{1}{2} - 3\frac{5}{6}$ $\quad$ **d.** $16\frac{5}{8} - 15\frac{2}{3}$ $\quad$ **e.** $27\frac{3}{4} - 16\frac{5}{6}$

6. **a.** $33\frac{2}{3} - 4\frac{4}{5}$ $\quad$ **b.** $26\frac{1}{4} - 12\frac{5}{6}$ $\quad$ **c.** $18\frac{2}{3} - 13\frac{3}{4}$ $\quad$ **d.** $25\frac{3}{4} - 8\frac{9}{10}$ $\quad$ **e.** $21\frac{2}{3} - 17\frac{7}{8}$

7. **a.** $24\frac{2}{5} - 16\frac{5}{6}$ $\quad$ **b.** $48\frac{3}{4} - 25\frac{1}{3}$ $\quad$ **c.** $69\frac{1}{3} - 32\frac{3}{4}$ $\quad$ **d.** $42\frac{4}{5} - 19\frac{7}{8}$ $\quad$ **e.** $37\frac{1}{6} - 13\frac{7}{8}$

8. Answer the following:

a. $5\frac{2}{3} - \ ? \ = 2\frac{11}{12}$ $\quad$ **c.** $20\frac{1}{7} - 8\frac{1}{2} = \ ?$

b. $? \ - 6\frac{3}{5} = 2\frac{13}{20}$ $\quad$ **d.** $31\frac{1}{8} - \ ? \ = 23\frac{7}{8}$

Multiplication of Fractions

The School District of Freeland added $\frac{3}{4}$ of an hour to each school day in order to take care of extra classes. How many hours were added to each school week?

Monday		Tuesday		Wednesday		Thursday		Friday	
$\frac{3}{4}$ hr.	+	$\frac{3}{4}$ hr.	+	$\frac{3}{4}$ hr.	+	$\frac{3}{4}$ hr.	+	$\frac{3}{4}$ hr.	$= \frac{15}{4}$ or $3\frac{3}{4}$ hr.

Instead of adding $\frac{3}{4}$ hr. five times you could have multiplied $5 \times \frac{3}{4} = \frac{15}{4} = 3\frac{3}{4}$ or $\frac{5}{1} \times \frac{3}{4} = \frac{15}{4} = 3\frac{3}{4}$ Explain.

Very often, work in multiplication can be shortened by using the process of **cancellation.** This may be used when you find that a numerator and a denominator can be divided by the same number. Tell how this has been done in the following examples:

$\overset{3}{\cancel{12}} \times \frac{3}{4} = 9$ $\qquad$ $\overset{7}{\cancel{14}} \times \frac{5}{\underset{3}{\cancel{6}}} = \frac{35}{3} = 11\frac{2}{3}$ $\qquad$ $\frac{\cancel{5}}{\underset{5}{\cancel{10}}} \times \frac{\overset{2}{\cancel{4}}}{\cancel{5}} = \frac{2}{5}$

In these examples you first ? and then multiply the ? and the ? .

Do these exercises:

1. $20 \times \frac{4}{5}$ $\qquad$ $\frac{2}{3} \times 12$ $\qquad$ $21 \times \frac{3}{8}$ $\qquad$ $\frac{5}{6} \times 14$ $\qquad$ $\frac{7}{9} \times 63$

2. $\frac{2}{5} \times \frac{4}{5}$ $\qquad$ $\frac{4}{5} \times \frac{5}{8}$ $\qquad$ $\frac{2}{3} \times \frac{4}{5}$ $\qquad$ $\frac{4}{7} \times \frac{5}{8}$ $\qquad$ $\frac{7}{8} \times \frac{16}{49}$

If $1\frac{1}{4}$ hours were added to the school day, you would then multiply this mixed number by 5.

$5 \times 1\frac{1}{4} = 5 \times \frac{5}{4} = \frac{25}{4} = 6\frac{1}{4}$ In vertical form this is:

$$\begin{array}{r} 1\frac{1}{4} \\ \times\ 5 \\ \hline 1\frac{1}{4} \\ 5 \\ \hline 6\frac{1}{4} \end{array}$$

When two mixed numbers are to be multiplied, you can change the mixed numbers to improper fractions and then multiply as with fractions. Why?

3. $1\frac{1}{2} \times 2\frac{2}{3}$ $\qquad$ **6.** $5\frac{3}{4} \times 8\frac{1}{4}$ $\qquad$ **9.** $39 \times 8\frac{1}{3}$

4. $4\frac{1}{2} \times 1\frac{2}{3}$ $\qquad$ **7.** $6\frac{3}{4} \times 1\frac{1}{4}$ $\qquad$ **10.** $48 \times 3\frac{1}{4}$

5. $3\frac{1}{4} \times 2\frac{1}{2}$ $\qquad$ **8.** $8\frac{1}{2} \times 9\frac{1}{3}$ $\qquad$ **11.** $96 \times 8\frac{1}{2}$

Division of Fractions and Mixed Numbers

The school day at New Falls School was 6 hours long. The day was divided into $\frac{3}{4}$ hour periods. How many periods were in each day?

There are 24 quarter hours in 6 hours. Why?

Divide the 24 quarter hours into groups of 3. Why?

There were 8 periods in each day.

This is how you can solve this problem:

$6 \div \frac{3}{4} = 6 \times \frac{4}{3} = \frac{24}{3}$ or 8

When fractions are used in division, you can invert the divisor and multiply. When the divisor is a mixed number, you change it to an improper fraction, invert it, and then multiply.

Do the following exercises:

1.	2.	3.	4.
a. $\frac{1}{4} \div 2$	**a.** $\frac{5}{10} \div 2$	**a.** $6 \div \frac{1}{2}$	**a.** $2 \div \frac{3}{8}$
b. $\frac{3}{4} \div 3$	**b.** $\frac{10}{12} \div 4$	**b.** $8 \div \frac{2}{3}$	**b.** $10 \div \frac{5}{8}$
c. $\frac{5}{6} \div 5$	**c.** $\frac{18}{19} \div 6$	**c.** $4 \div \frac{3}{4}$	**c.** $21 \div \frac{3}{10}$
d. $\frac{9}{10} \div 3$	**d.** $\frac{13}{15} \div 3$	**d.** $9 \div \frac{1}{3}$	**d.** $9 \div \frac{7}{8}$
e. $\frac{15}{16} \div 5$	**e.** $\frac{6}{7} \div 2$	**e.** $9 \div \frac{5}{8}$	**e.** $13 \div \frac{2}{3}$

5.	6.	7.	8.
a. $\frac{1}{3} \div \frac{1}{4}$	**a.** $\frac{6}{7} \div \frac{3}{8}$	**a.** $1\frac{1}{2} \div 5$	**a.** $1\frac{1}{3} \div 3\frac{1}{7}$
b. $\frac{8}{9} \div \frac{2}{3}$	**b.** $\frac{11}{12} \div \frac{6}{7}$	**b.** $1\frac{2}{3} \div 4$	**b.** $8\frac{1}{3} \div 1\frac{2}{3}$
c. $\frac{3}{8} \div \frac{2}{3}$	**c.** $\frac{8}{15} \div \frac{2}{9}$	**c.** $3\frac{2}{3} \div 3$	**c.** $3\frac{1}{7} \div 3\frac{1}{2}$
d. $\frac{15}{16} \div \frac{1}{4}$	**d.** $\frac{6}{13} \div \frac{2}{39}$	**d.** $2\frac{7}{8} \div 2$	**d.** $8\frac{2}{3} \div 2\frac{1}{6}$
e. $\frac{5}{6} \div \frac{4}{5}$	**e.** $\frac{19}{20} \div \frac{20}{21}$	**e.** $1\frac{3}{4} \div 5$	**e.** $2\frac{1}{4} \div 1\frac{1}{8}$

Kinds of Problems Using Fractions

1. George had an allowance of \$5.00 a week. He spent $\frac{2}{5}$ of it for lunches. How much did he spend?

$\frac{2}{5}$ of \$5.00 = \$2.00

In this kind of problem you find a fractional part of the whole.

2. George had an allowance of \$5.00 a week. He spent \$2.00 for lunches. What fractional part did he spend for lunches? \$2.00 is what fractional part of \$5.00? $\frac{2}{5}$ = the fractional part. Why?

In this kind of problem you find what fractional part the part is of the whole.

3. George spent \$2.00, which was $\frac{2}{5}$ of his allowance. What was his allowance? 2 is $\frac{2}{5}$ of what number? $2 \div \frac{2}{5} = \cancel{2} \times \frac{5}{\cancel{2}} = 5$

In this kind of problem, you find the whole when the part and fractional part of the whole are given.

4. Find:

a. $\frac{2}{3}$ of 9 **b.** $\frac{9}{10}$ of 30 **c.** $\frac{5}{6}$ of 9 **d.** $\frac{7}{8}$ of 64 **e.** $\frac{3}{4}$ of 7 **f.** $\frac{4}{9}$ of 35 **g.** $\frac{8}{11}$ of 44 **h.** $\frac{11}{12}$ of 96

5. What fractional part of:

a. 18 is 6? **b.** 12 is 8? **c.** 40 is 15? **d.** 45 is 20? **e.** 36 is 16? **f.** 45 is 30? **g.** 75 is 60? **h.** 875 is 125?

6. **a.** 16 is $\frac{2}{3}$ of what number?
b. 15 is $\frac{3}{4}$ of what number?
c. 12 is $\frac{3}{8}$ of what number?
d. 25 is $\frac{5}{8}$ of what number?
e. 30 is $\frac{9}{10}$ of what number?
f. $\frac{5}{6}$ of what number is 50?
g. $\frac{4}{5}$ of what number is 16?
h. $\frac{7}{10}$ of what number is 42?
i. $\frac{8}{9}$ of what number is 40?
j. $\frac{6}{7}$ of what number is 72?

7. Five-sixths of a certain number is 15. What is the number?

8. Twenty-seven is what fractional part of 243?

9. What is seven-fifteenths of 165?

Problems with Fractions

Calorie-watching Jane found a recipe for non-fattening cup cakes.

$\frac{1}{2}$ cup cake flour
$\frac{3}{8}$ tsp. baking powder
$\frac{1}{8}$ tsp. salt
1 egg
$3\frac{1}{2}$ tbsp. sugar
$\frac{3}{4}$ tsp. lemon juice
$3\frac{3}{4}$ tbsp. dry milk
$\frac{1}{4}$ cup water
$\frac{1}{3}$ cup orange juice
(Recipe makes 8 cakes)

1. Jane tried half the recipe at first to see if she liked the cakes. Write the recipe for half the amount.

2. The cakes were good, so Jane made them for her club meeting. There were 8 girls in the club, and Jane allowed 3 cakes for each girl. Write the recipe Jane used.

3. Jane served ice cream with the cakes, allowing $\frac{3}{4}$ cup for each girl. How many cups of ice cream would she need for the 8 girls?

4. If there were 2 cups of ice cream to a pint, how many quarts would Jane have to buy?

5. If the ice cream cost 65 cents a quart, how much did Jane have to pay for the amount she needed?

6. Three cakes were left at the end of the meeting. What fractional part was left? What fractional part was eaten?

7. Jane found that she got $\frac{1}{8}$ cup of lemon juice from one lemon. In a recipe for lemonade, $\frac{3}{4}$ cup of lemon juice was required. How many lemons would Jane need for the lemonade?

8. If $1\frac{3}{4}$ cups of sugar were needed for 1 quart of lemonade, how many cups would be needed for 3 quarts?

9. Later Jane made cup cakes for her brother and frosted them. The recipe for frosting called for $\frac{1}{4}$ cup corn syrup, 1 egg white, $\frac{3}{8}$ tsp. salt, and $\frac{3}{4}$ tsp. vanilla. If Jane tripled (3 times) the recipe, write it as Jane used it.

More Problems with Fractions

1. The Smith family found that they were spending $\frac{2}{3}$ of their salary on food and clothing. If Mr. Smith's income was $420 a month, how much was the family spending on food and clothing?

2. If $\frac{1}{8}$ inch represents one mile, how long a line would you draw to represent 5 miles? 12 miles? 25 miles? 30 miles? 40 miles?

3. Helen bought $3\frac{3}{4}$ yards of material for $.95 a yard. How much did it cost her?

4. If a quarter pound of butter cost 19¢, how much would a pound cost?

5. A pair of shoes cost a shoestore owner $3.50. This amount was $\frac{3}{5}$ of the selling price. What was the selling price?

6. Sue worked at the dry goods counter of the Grand Department Store. One morning she received a 50-yard bolt of linen. During the day she sold the following lengths: $4\frac{3}{4}$ yd., $2\frac{1}{2}$ yd., $5\frac{3}{4}$ yd., $3\frac{1}{4}$ yd. How much was left on the bolt of linen at the end of the day?

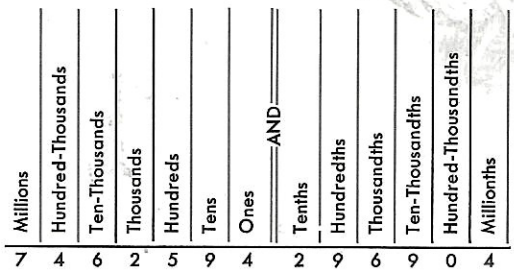
7. Ben helped his father paint after school. If he worked $1\frac{1}{2}$ hours each school day, how many hours did he work from Monday through Friday? His father paid him $.75 an hour. How much did Ben earn in a week?

8. Howard lives $3\frac{1}{2}$ blocks from school while his friend John lives $9\frac{1}{2}$ blocks away. John lives how many times farther from school than Howard?

9. Bill and Jim rode their bicycles $4\frac{1}{2}$ miles to the state park. The manager of the park told the boys that the park was $2\frac{3}{4}$ miles long and $1\frac{1}{3}$ miles wide. If the boys rode around the edge of the park, how far was the distance around? Counting the miles coming and going, how many miles did the boys ride altogether?

Decimals in Measurements

Your ruler is divided into quarters, halves, eighths, etc. These are fractions. The surveyor's chain is divided into tenths of an inch, and other instruments are divided into hundredths and thousandths of an inch. These can be called decimal fractions. Decimals are values which show that the numbering is by tens. For example, 962. is a whole number decimal. Why? 962.52 is a mixed decimal. Why? 0.52 is a decimal fraction. Why? The decimal point indicates the end of the whole number and the beginning of the fractional part of the number. It is read as the word *and*. There is always a decimal point understood at the end of a whole number. For example, 78 is the same as 78. and 78.0. Numbers to the right of the decimal point end with *ths*.



This number is read seven million, four hundred sixty-two thousand, five hundred ninety-four, *and* two hundred ninety-six thousand nine hundred four million*ths*.

Read the following numbers:

a. 4,400
b. 4.4
c. 0.44
d. 0.4
e. 0.4000
f. 4,444.44
g. 0.0044
h. 440.404
i. 440,000
j. 0.000004
k. 4,000,0004.4
l. 440,004.0004

Decimal fractions like 0.3, 0.1, 0.52, and 0.006 may be written as common fractions: $\frac{3}{10}$, $\frac{1}{10}$, $\frac{52}{100}$, and $\frac{6}{1000}$. Write these numbers as fractions: 0.7, 0.007, 0.77, 0.7777.

In this book the word fraction means common fraction.

Decimal fractions may be rounded to tenths, hundredths, thousandths, etc. depending upon the accuracy needed.

For example:

17.46 rounded to the nearest tenth is 17.5.
226.493 rounded to the nearest hundredth is 226.49.
15.9648 rounded to the nearest thousandth is 15.965.

Changing Fractions to Decimals

$\frac{4}{5} = \frac{8}{10} = .8$ $\frac{3}{20} = \frac{15}{100} = .15$ $\frac{17}{50} = \frac{34}{100} = .34$ Why?

Change the following fractions to decimals:

$\frac{1}{5}$ $\frac{1}{4}$ $\frac{3}{4}$ $\frac{7}{10}$ $\frac{13}{20}$ $\frac{11}{50}$ $\frac{11}{20}$ $\frac{2}{5}$ $\frac{9}{10}$ $\frac{1}{10}$ $\frac{7}{25}$ $\frac{3}{25}$ $\frac{17}{50}$ $\frac{11}{50}$ $\frac{45}{50}$ $\frac{9}{25}$ $\frac{40}{50}$

Fractions may also be changed to decimal fractions by dividing the numerator of the fraction by the denominator.

Example: Change $\frac{1}{6}$ to a decimal. Divide 1 by 6. Since there will always be a remainder, continue your division by annexing zeros until you have a decimal of the number of places necessary in your work. The answer will then be approximately correct and may be rounded to the nearest tenth, hundredth, or thousandth. In this case, $.166\frac{2}{3}$ rounded to the nearest thousandth is .167. Since $\frac{2}{3}$ is larger than a half, one was added to the preceding number.

$$
\begin{array}{r}
.166\frac{2}{3} \\
6\overline{)1.000} \\
6 \\
\hline
40 \\
36 \\
\hline
40 \\
36 \\
\hline
4
\end{array}
$$

Example: In three baseball games Donald was at bat 16 times and made 11 hits. What was his batting average? The answer was carried to three decimal places, as is always done in baseball. The number rounded would be .688. Why?

$$
\begin{array}{r}
.687\frac{1}{2} \\
\frac{11}{16} = 16\overline{)11.000} \\
96 \\
\hline
140 \\
128 \\
\hline
120 \\
112 \\
\hline
8
\end{array}
$$

1. Write these as decimals (to the nearest hundredth):

$\frac{3}{8}$ $\frac{5}{7}$ $\frac{2}{9}$ $\frac{5}{6}$ $\frac{7}{8}$ $\frac{2}{3}$ $\frac{9}{14}$ $\frac{10}{11}$ $\frac{9}{16}$ $\frac{9}{11}$ $\frac{15}{17}$ $\frac{24}{27}$ $\frac{8}{13}$ $\frac{9}{17}$

2. Prove that these are correct.

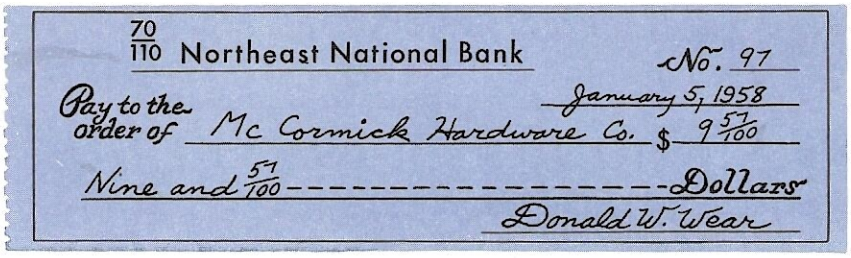
$\frac{1}{16} = .0625$ $\frac{1}{64} = .015625$ $\frac{3}{32} = .09375$

$\frac{7}{32} = .21875$ $\frac{1}{32} = .03125$ $\frac{15}{16} = .93750$

3. Express $7\frac{7}{50}$ in decimal form: Since $\frac{7}{50} = \frac{14}{100} = .14$, the number could be written 7.14.

4. Change these mixed numbers to decimal form:

$2\frac{2}{3}$ $5\frac{1}{6}$ $7\frac{1}{5}$ $19\frac{4}{5}$ $8\frac{7}{8}$ $10\frac{1}{16}$ $11\frac{9}{50}$ $12\frac{5}{6}$ $25\frac{11}{25}$


70
110 Northeast National Bank

No. 97

January 5, 1958

Pay to the order of Mc Cormick Hardware Co. $ 9 57/100

Nine and 57/100 ---------- Dollars

Donald W. Wear

Changing Decimals to Fractions

Here is a picture of a check written by Mr. Wear for a bill he owed at McCormick's hardware store. You notice that the amount of money he owed was \$9.57, but it is written on the check $\$9\frac{57}{100}$. This is done to make certain that no mistake will be made in the placing of the decimal point.

A decimal can always be changed to a common fraction by making its denominator 10, 100, 1000, etc. For example:

$.75 = \frac{75}{100} = \frac{3}{4}$ Also $.055 = \frac{55}{1000} = \frac{11}{200}$

1. Change these decimals to common fractions:

.555 .96 .108 .95 .1275 .85 .0125 .004 .69 .005

2. Can you tell which is larger?

.75 or $\frac{3}{5}$ .02 or $\frac{2}{1000}$ .20 or $\frac{1}{4}$ .04 or $\frac{1}{20}$ .95 or $\frac{17}{20}$
.8 or $\frac{5}{8}$ .81 or $\frac{5}{6}$ .375 or $\frac{2}{3}$ .875 or $\frac{5}{6}$ .72 or $\frac{3}{4}$

3. Arrange the following groups of decimals in order, beginning with the largest:

.3 .003 .0028 2.003 .001 .01 .10 1.01
6.07 6.70 6.007 6.0707 90.01 90.002 90.10 90.2

4. Find the largest and the smallest number in each of the following groups:

.7 .073 .326 .69 94.7 9.47 .947 .0947
2.15 4.9 .7298 .0743 723.1 1278 83.15 .1273

5. Practice for skill:

a. \$85.20 − \$13.21
b. 16 × \$19.52
c. \$.37 + \$1.96 + \$.78 + \$99
d. $6 \times 1\frac{1}{2}$ cents
e. $19.67 - 7\frac{1}{8}$
f. $2\frac{7}{8} - 1.75$
g. \$17.65 ÷ 3
h. $9 \times \$.17\frac{1}{2}$

Rounding Decimals

Machinists often need to round decimal fractions to familiar fractions, for example, to the nearest $\frac{1}{8}$ inch or $\frac{1}{16}$ inch. The decimal fraction .247 would round to .25, to $\frac{25}{100}$, to $\frac{1}{4}$ inch.

Here are some other ways in which a round number would be used instead of a more nearly exact number:

1. Mr. Wear drove his car to the shore, a distance of 69 miles, in $1\frac{3}{4}$ hours. What was his average number of miles per hour?

$$
\begin{array}{r}
39.42 \\
1.75\overline{)69.0000} \\
525 \\
\hline
1650 \\
1575 \\
\hline
750 \\
700 \\
\hline
500 \\
350 \\
\hline
150
\end{array}
$$

Instead of saying his average mileage was 39.42, you can say it was 39 miles per hour. Why?

2. The Wilson Basketball Team won 9 games and lost 4 games. What was their standing for the term? Express this as a 3-place decimal.

$9 + 4 = 13$ games played. $\quad \frac{9}{13} = 13\overline{)9.0000}$ (.6923)

The standing was .692. Check the figures.

> In rounding a decimal, you use a decimal of one more place than what is wanted. When the figure in the last place is less than 5, you drop it. When it is 5 or more, you add 1 to the first figure on its left.

Example: .574 to the nearest hundredth is .57; to the nearest tenth is .6.

3. Round these numbers to the nearest hundredth; to the nearest tenth.

.675 1.248 27.912 4.97 3.782 .059

Are Decimal Points Important?

Can you place the decimal point where it belongs in the following statements? This is called common-sense arithmetic.

1. **2.** **3.** **4.**

Christmas Trees	Model Plane	Scout Axe	Jar of Mincemeat
$450	$4950	$995	$500

5. Donald's living room measures 245 ft. by 145 ft.

6. Mr. Wear averages 175 miles to a gallon of gasoline.

7. The teacher's desk is about 456 inches long.

8. In each class at Wilson Junior High there is an average of 312 pupils.

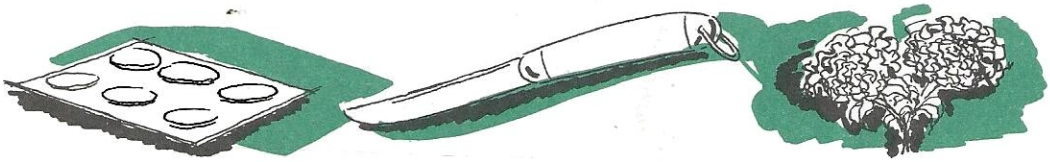
9. Mrs. Smith lost 155 lb. last year.

10. Baby Susan weighed 725 lb. when she was born.

11. The teacher's chalk is 45 inches long.

12. Greeting cards were $100 a box, or $1000 each.

13. **14.** **15.**



Cookies	Pocket Knife	Carnations
$85 a dozen	$65	$450 a dozen

16. You may spend 35 hours in church on Sunday.

17. Our vacation lasted 2500 weeks.

18. The train went 855 miles an hour.

19. The temperature last winter registered 125 degrees below zero.

20. In summer our average temperature is 725 above zero.

Reading Decimals

In everyday life, the decimals you use are seldom more than 2- or 3-place decimals. For example, you find numbers like these: $15.25 or $2.46. Such numbers are part of business-world arithmetic.

If you should become a scientist or an engineer, you would need to know how to measure correctly to ten thousandths, or hundred thousandths, or even to millionths of an inch, so you would use decimals with five or six places. Measurements of tomorrow may use billionths of an inch. How many decimal places would this be?

Can you write these decimals?

1. A human hair measures three thousandths of an inch.

2. A small part in the engine of an automobile is measured correctly to five ten thousandths of an inch.

3. Some gauges are correct to one hundred thousandth of an inch.

4. A photograph of a moving train was exposed for five thousandths of a second.

5. An electric gauge measures correctly to within ten millionths of an inch.

6. The new measurements for the future may measure correctly to the nearest billionth of an inch.

Can you read these decimals?

a. .09	**e.** 200.02	**i.** 25.250	**m.** 2000.02
b. .409	**f.** 6.0025	**j.** .9	**n.** 56.001
c. 374.9	**g.** 300.009	**k.** 295.295	**o.** 5.055
d. .80	**h.** .295	**l.** 1.0001	**p.** 99.0999

Write these in figures:

1. Nine hundred seventy-five thousandths
2. Ten and nine hundredths
3. Nine and thirty-five thousandths
4. One and one hundredth
5. Nine and nine tenths
6. Ninety-nine thousandths
7. Nine hundred and nine tenths
8. Ninety-nine and nine hundredths

Test Yourself on Decimals

1. Doctors in Centerville gave children .14 cubic centimeters of polio vaccine per pound of weight. If a child weighed 52 pounds, how many cubic centimeters of vaccine did the child receive?

2. The year 1953 saw the United States government with a deficit of $9.4 billions. Write this as a number.

3. The first time Tom tried for the mile-run record his time was 4 minutes and 1.3 seconds. The second time his record was 4 minutes and 0.7 seconds. What was the difference between the two records?

4. Mrs. Reed bought staple groceries amounting to $8.96, meat for $6.42, and fruit for $1.19. How much change did she receive from $20.00?

5. Mr. Wear took his wife and 4 children to a restaurant for dinner. The bill was $10.50. How much was each dinner if they all ordered the same thing?

6. Mr. Evans' mileage on his car for the summer months was as follows: June 829.6 miles, July 1462.9 miles, August 946.7 miles. What was his total mileage for the summer? What was his average mileage per month?

7. The weight of one cubic foot of water is 62.5 lb. Ice weighs .92 times as much as water. How much does a cubic foot of ice weigh?

8. A car traveled 281 miles on 15 gallons of gasoline. How many miles to the nearest tenth did the owner get per gallon?

9. Jerry kept an account of his incidental expenses during his week's stay at camp. Every day he paid $.17 for a soda and $.12 for a package of cookies. Beside this he spent the following: Monday $.27, Tuesday $.08, Wednesday $.45, Thursday $.65, Friday $.15, Saturday $.82, and Sunday $.25. How much were Jerry's total incidental expenses?

10. The cost of a super highway for 102.2 miles was $4,556,000. What was the average cost per mile?

11. What is the total cost of 16 gallons of gasoline at 29.9 cents per gallon, and 2 quarts of oil at 31.5 cents per quart?

12. It is 10.6 miles from Lincoln High to Northeast High. What is this distance in yards? (one mile = 5,280 ft.)

Practice on Fundamentals with Decimals

1. Add:

a.	b.	c.	d.	e.	f.	g.
.2	.54	.01	7.12	3.5	296.75	76.14
.3	.78	.03	15.08	7.	26.92	42.
.6	.39	.06	29.12	9.72	132.07	952.61

2. Subtract:

a.	b.	c.	d.	e.	f.	g.
3.7	.69	.523	27.3	100.	501.76	856.31
.6	.62	.352	12.42	.98	98.49	99.45

3. Multiply:

a.	b.	c.	d.	e.	f.
$8 \times .4$	$.53 \times 9$	12×3.4	8.7×3.14	$.673 \times .2$	$.05 \times .02$
$5 \times .21$	$.34 \times .8$	$.47 \times 1.2$	6.4×40.1	$.87 \times .42$	$7.56 \times .05$
$.6 \times .7$	$.25 \times .2$	4.3×6.5	3.2×4.1	$8.49 \times .02$	9.5×5.6

4. Divide:

a.	b.	c.	d.	e.
$3\overline{)2.7}$	$11\overline{).55}$	$6\overline{)12.45}$	$15\overline{)84.12}$	$2.4\overline{)9.6}$
$4\overline{)8.4}$	$15\overline{).45}$	$9\overline{)41.67}$	$16\overline{)23.69}$	$.53\overline{)2.65}$
$9\overline{)27.9}$	$20\overline{).6000}$	$7\overline{)381.5}$	$21\overline{)9.347}$	$.67\overline{).201}$

5. Add:

a.	b.	c.	d.	e.
4.080	268.51	.0917	$156.72	.496
390.020	13.001	.0321	246.96	3.98
568.	7.721	.0291	72.49	43.62
.091	42.	.1929	876.95	9.574

6. Subtract:

a.	b.	c.	d.	e.
27.09	5.986	1.0640	0.9670	4.980
13.38	.064	.8704	.1776	1.097

7. Divide:

a.	b.	c.	d.	e.
$4.6\overline{)924.6}$	$.08\overline{)56.32}$	$.008\overline{).6496}$	$700\overline{).494900}$	$.002\overline{)7684}$

Multiplication by 10, 100, 1,000

Betty Wear's girls' club had been saving all year for a trip to New York. Mrs. Wear agreed to be the sponsor for the 10 girls. While in New York, they went to Radio City Music Hall, where they each paid $1.65 admission. How much did this cost them altogether?

$10 \times \$1.65 = \$16.50$

After the show they went on a guided tour of Rockefeller Center. The cost was $.85 each, for children. What amount was spent here?

$10 \times \$.85 = \$8.50$

They had dinner at a hotel at a cost of $1.75 each. What was the total cost?

$10 \times \$1.75 = \$17.50$

Notice that the answers were obtained without any work. Everyone should be able to multiply numbers by 10, 100, or 1,000 without using pencil or paper.

$10 \times 2.42 = 24.2$
$100 \times 2.42 = 242$
$1{,}000 \times 2.42 = 2{,}420$

To multiply a number by 10, 100, or 1,000, move the *decimal point to the right* as many places as there are zeros in the multiplier.

Without using pencil and paper multiply each of these numbers by 10, 100, and 1,000:

a. $.82	**d.** 62.5	**g.** 62.75	**j.** $.25
b. $235	**e.** .9162	**h.** 6.2	**k.** $.12\frac{1}{2}$
c. $25.62	**f.** $9.46	**i.** $17.25	**l.** $8.79

1. a. How much will 100 3-cent stamps cost?
b. How much will 10 2-cent stamps cost?
c. How much will 100 2-cent post cards cost?

2. What will 10 tons of coal cost at $21.75 a ton?

3. How much will 10 lb. of sugar cost at $8\frac{1}{2}$ cents a lb.?

4. Mr. Stevens sold 100 quarts of milk on Saturday at $26\frac{1}{2}$ cents per quart. How much money did he get for the milk?

5. Mr. Marr has a storage tank on his farm for 1,000 gallons of fuel oil. If he fills it at the beginning of winter at $13\frac{1}{2}$ cents a gallon, how much will it cost him?

Division by 10, 100, 1,000

Mr. Boswell is a wholesale lumber dealer. Some of his prices are:

> Western fir $90.00 per thousand board feet
> West Coast lumber $108 per thousand board feet
> Oak moulding $7.00 per hundred feet

Find the cost per foot for the above.

$90.00 ÷ 1,000 = $.09 per board foot
$108 ÷ 1,000 = $.10$\frac{8}{10}$ per board foot
$7.00 ÷ 100 = $.07 per foot

It is just as easy to divide by 10, 100, or 1,000 as it is to multiply. You move the decimal point to the left instead of the right as many places as there are zeros in the divisor.

1. Divide each of these numbers by 10, 100, and 1,000 without pencil and paper:

a. 45	**d.** 2.35	**g.** .6	**j.** 7.6	**m.** 67.20
b. 62.7	**e.** 23.5	**h.** .7	**k.** .924	**n.** 94.5
c. 537	**f.** .235	**i.** .03	**l.** 1800	**o.** 86.75

2. Do not use pencil and paper for these:

a. A runner ran 100 yards in 9.7 seconds. What part of a second did it take to run 1 yard?

b. The Lincoln High School paid $45.00 total tax on 1,000 tickets. How much tax was this for each ticket?

c. Mr. Wear paid $3.12 for 10 gallons of gasoline. How much was this per gallon?

d. Donald bought a box of 10 candy bars for 55 cents. How much was this for each bar?

e. Potatoes cost 37 cents for a 10-pound bag or $3.60 for 100 pounds. How much is saved by buying the 100-pound bag instead of ten 10-pound bags?

f. Mr. Werner paid $60.00 for 100 dozen oranges. How much was this per dozen?

g. When Mrs. Wear came back from New York, she found that Betty's club had $7.50 left. This was divided among the 10 girls. How much did each girl get?

Review of Fundamentals Using Decimals

1. Read these numbers:

a. 3.52 **d.** .40672
b. 9.1 **e.** 200.8
c. 1.005 **f.** 8.0091

2. Write these numbers in words:

a. 9.123 **d.** 3.0907
b. .00345 **e.** 156.000016
c. 8.0076 **f.** 10.0001

3. Change these fractions to decimals:

a. $\frac{5}{6}$ **d.** $\frac{9}{25}$
b. $\frac{7}{11}$ **e.** $\frac{11}{50}$
c. $\frac{11}{20}$ **f.** $\frac{19}{23}$

4. Change these decimals to fractions:

a. 2.64 **d.** .35
b. .375 **e.** .425
c. .18 **f.** 6.85

5. Round these numbers, first to nearest hundredth, then to nearest tenth:

a. 14.52 **c.** .715 **e.** 65.6839 **g.** 3.075 **i.** 7.187
b. 6.942 **d.** 4.046 **f.** .40562 **h.** .664 **j.** 206.007

6. Multiply each number by 10, 100, 1000:

a. 8.6 **c.** .009
b. \$.65 **d.** $7\frac{1}{2}$ cents

7. Divide each number by 10, 100, 1000:

a. 7.52 **c.** 79.001
b. 156.42 **d.** 18.56

8. Change to cents or dollars and cents:

a. $\$\frac{1}{4}$ **c.** $\$3\frac{1}{2}$ **e.** $\$\frac{5}{6}$ **g.** $\$1\frac{21}{25}$ **i.** $\$5\frac{19}{20}$
b. $\$\frac{3}{4}$ **d.** $\$7\frac{1}{5}$ **f.** $\$5\frac{13}{20}$ **h.** $\$\frac{3}{5}$ **j.** $\$2\frac{9}{10}$

9. Add:

a. \$1.26 + \$.48 + \$7.15 + \$.95
b. \$1.01 + \$10 + \$10.10 + \$.10
c. 100.76 + 17.42 + 2000
d. 36.5 + 17 + .13 + 14.17

10. Subtract:

a. \$4.60 − \$2.78 **c.** .536 − .007 **e.** .8 − .004
b. \$45.50 − \$17.87 **d.** .0076 − .007 **f.** .15 − .072

11. Multiply:

a. .5 × .5 **c.** 28 × .6 **e.** 17.65 × .21 **g.** 2.3 × .008
b. .7 × .29 **d.** .403 × .91 **f.** 25 × $\$.12\frac{1}{2}$ **h.** 6.03 × .409

12. Divide: **a.** $.6\overline{).48}$ **c.** $16\overline{).08}$ **e.** $.9\overline{).81}$
b. $.13.\overline{)26}$ **d.** $.012\overline{).0144}$ **f.** $3.14\overline{)13.6}$

A Page of Problems

1. In such a crowded city as New York, it is difficult to realize that there are so many open parks. This ground which is kept in parks is of course very valuable. Find the total value of these parks: Central Park $490,000,000; Prospect Park $59,850,000; Riverside Park $43,159,000; Manhattan Square Park $15,300,000; and Pelham Bay Park $17,170,000.

2. It is estimated that it costs $136,000 a mile to pave streets today. At that rate, how much would it cost to repair New York's 4,098 miles of streets?

3. Donald's class decided to sell candy bars to make money. They bought 100 bars at $7\frac{1}{4}$ cents a bar and sold them at 10 cents each. How much did they make?

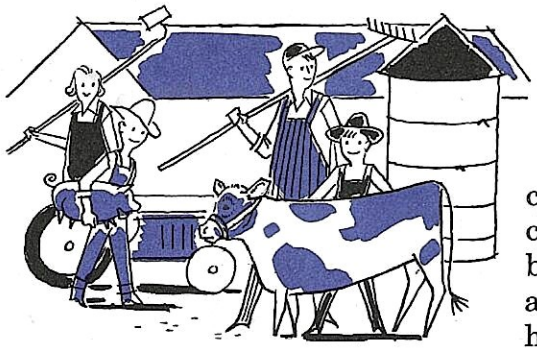
4. Bricks are sold at so much per 1,000 bricks. If a builder bought 15,500 bricks at $47.50 per thousand, how much did each thousand cost?

5. Seventy-six boxes of candy each weighing $\frac{3}{4}$ of a pound were sent to the post office. What was the total weight? If the postal charge was $.17 per box, how much did it cost to send all of these by mail?

6. The pitcher on a baseball team won 17 games out of 25 played. Find his record of wins, correct to 3 decimal places. (17 ÷ 25 = ?)

7. Elsie's club covered boxes with flowered material to sell at the school bazaar. In order to match the pattern, $\frac{1}{4}$ yard of material was wasted on each box. If there were 30 girls in the club and each girl made 2 boxes, how much material was wasted? What was the cost of the material at $.20 per yard?

8. At the beginning of their last school term, the girls decided to make their own graduation dresses all alike. Mrs. Holmes, the teacher, found that she could get the material wholesale at $.95 a yard. If there were 45 girls in the class and each girl needed an average of $4\frac{3}{4}$ yards, how much did the material cost? Other materials cost $.65 for each dress. The same dress, if bought in the store, would have cost $8.95. How much did each girl save?



Boys and Girls on the Farm

1. John Baker, a 16-year-old 4-H club member, grew 143 bushels of corn per acre at a cost of $.26 per bushel. If he raised 5 acres of corn and sold it for $785, how much did he make per acre?

2. Twenty-nine 4-H club members in West Virginia planted 1,000 strawberry plants each. They sold 13,243 quarts of berries for $5,926.76.

a. How many plants did the club members have altogether?

b. Would you say the average yield per plant was 1 quart? $\frac{1}{2}$ quart? 2 quarts? 1 pint?

c. What was the average selling price per quart of berries?

3. Jim Wilbur picked 983 quarts of berries from his 1,000 plants and sold them for $404.

a. How many quarts per plant was his yield?

b. What was the average selling price per quart?

4. Donald Britt was a member of the Future Farmers of America. He grew tomatoes and beets for a cannery. One year he made $2,211 on 6 acres of tomatoes and $991 on 6 acres of beets.

a. How much did he make on the 12 acres?

b. What was his average return per acre?

c. He paid his father $12.00 an acre for the ground. How much did he pay his father?

d. What was his profit?

5. Ed Miller and his father kept 5,000 hens. They counted on 5 eggs per week per hen. They sold the eggs at $.50 a dozen.

a. How many eggs should they get from 5,000 hens a year?

b. How many dozen?

c. What should their total returns be per year?

d. If each hen eats $8.00 worth of food a year, what is the profit on each hen?

Review Problems

Fundamental Review

1. Do what the sign tells you to do:

a. $7656 + 9849$
b. $17287 - 8948$
c. 572×67
d. $968 \div 8$
e. $2000 - 876$
f. $98201 - 8745$
g. 767×920
h. $27\overline{)14607}$
i. $97 + 86 + 29$
j. $5000 - 4873$
k. 8020×209
l. $76\overline{)37240}$

2. Write these numbers in figures:

a. $1\frac{1}{2}$ billion
b. 17 million
c. 6.3 million
d. 3.5 billion
e. $4\frac{1}{2}$ million
f. 5.25 million

3. Tell what each zero means in this number:

3,406,200,903

4. Round these numbers first to the nearest thousand, then to the nearest ten thousand:

a. 562,841
b. 79,420
c. 356,496
d. 591,720
e. 8,496,906
f. 499,846

5. Find the average of each of the following:

a. 46, 92, 83
b. 67, 46, 92
c. 87, 41, 38
d. 94, 98, 90
e. 87, 76, 86, 70
f. 92, 90, 95, 87

6. Do what the sign tells you to do:

a. $87\frac{1}{2} + 37\frac{3}{4}$
b. $46\frac{9}{10} - 18\frac{4}{5}$
c. $3\frac{1}{2} \times 4\frac{1}{4}$
d. $102\frac{1}{2} + 378\frac{1}{8}$
e. $30\frac{1}{2} \div 3\frac{1}{2}$
f. $2 \times 83\frac{1}{2}$

7. Write these numbers in words:

a. 5200
b. 5.2
c. 0.52
d. .052
e. 5.20
f. 520.0
g. .0052
h. .00052

8. Do what the sign says:

a. $.305 + 79$
b. $2.7 \times .37$
c. $6.7 + 2.8 + .28$
d. $96.6 \div .6$
e. $100 \times .007$
f. $2000 - 6.764$
g. $.009 \times .0003$
h. $7.6 \div .002$

9. Change these decimals to fractions in their lowest terms:

a. .15
b. .76
c. .005
d. .175
e. .950
f. .86
g. .1250
h. .368

What Have You Remembered?

1. Explain how you multiply a number by 10, 100, or 1,000.

2. Explain how you divide a number by 10, 100, or 1,000.

3. Write a short paragraph on the history of our system of measurement.

4. What is meant by the metric system? Who uses it?

5. Is the meter stick longer or shorter than the yardstick?

6. Name a few common measuring instruments.

7. What is a standard? How does this word enter into the vocabulary of measurement?

8. What is a cubit?

9. What does drawing to scale mean?

10. If a room $24' \times 17'$ is drawn to a scale of $\frac{1}{2}$ inch to a foot, how large would the scale drawing be?

11. What is the unit of measure for time? for weight? for money?

12. Explain the words denominator, numerator, reduce, common fraction.

13. What are the names of the decimal places beginning with tenths and going to millionths?

14. How do you change a decimal to a fraction?

15. How do you change a fraction to a decimal?

16. What does it mean to round a number?

17. Round 1.792 to the nearest hundredth.

18. Why is a decimal point important?

19. When you add or subtract decimal fractions, what must you remember about the decimal point?

20. When you multiply decimal fractions, you place the decimal point in the answer after you have ? .

21. If you divide 32 by .08, you must first ? .

22. Does the government control measuring instruments? How?

23. Complete this statement: Before I add $1\frac{2}{3}$, $3\frac{4}{9}$, and $2\frac{1}{6}$ I must ? .

24. Give examples of a common fraction, a decimal fraction, a mixed decimal, and an improper fraction.

Unit Test

1. Fill in the blank spaces in the sentences below:

a. In 1799 the French government adopted the ? system of measurement.

b. About the same time the United States adopted the ? system of measurement.

c. In early measurement the cubit was the ? .

d. The meter is ? than the yard.

e. All United States standards of measure are kept in ? .

2. Mr. Grant had a general store. He purchased 75 brooms at 50 cents each, 100 maps at $.75 each, and 25 bolts of dish toweling at $7.50 a bolt. What was his total bill?

3. A volley ball court should measure 60′ by 30′. The top of the net should be 8 feet from the ground, and the net, when stretched, measures 32 feet. If you used a scale of $\frac{1}{8}'' = 1$ foot, how long would these measurements be in a scale drawing?

4. The United States mint at Denver produces 4.5 million pennies a day. What is this amount in dollars?

5. Change $\frac{23}{38}$ to a decimal, correct to hundredths.

6. Change .76 to a fraction in its lowest terms.

7. Multiply each number by 10, 100, 1,000:

720 42.5 17.623 92.4 850

8. Divide each number by 10, 100, 1,000:

76.4 270 6.4 .974 17.62

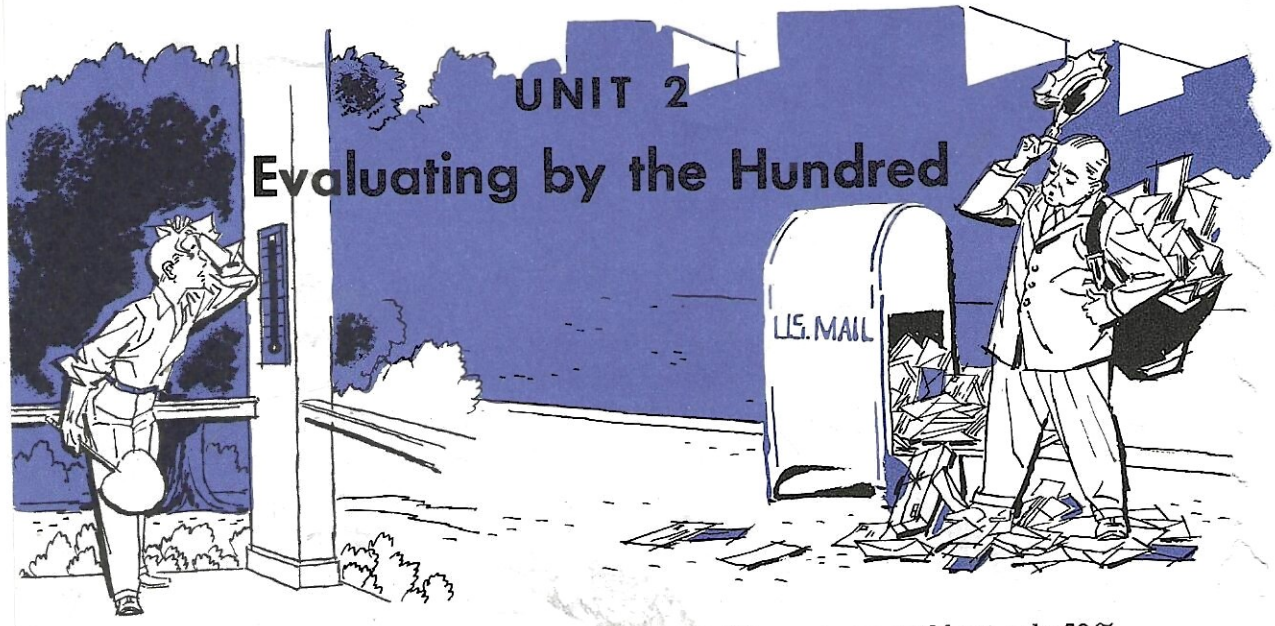
9. How many bars of candy, at $6\frac{1}{2}$ cents each, could be bought for $9.75?

Figuring for Fun

1. Multiply 41,152,263 by 3. What is queer about your answer?

2. Promise to work for your father if he will double your pay each day. (For example, the first day 1 cent, second day 2 cents, third day 4 cents, etc.) How much would you get on the 15th day?

UNIT 2
Evaluating by the Hundred

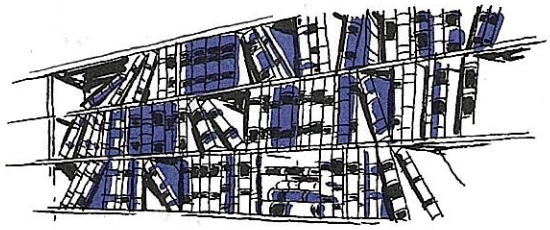


The humidity reading was 88%.

The postman could get only 50% of the mail in his bag.

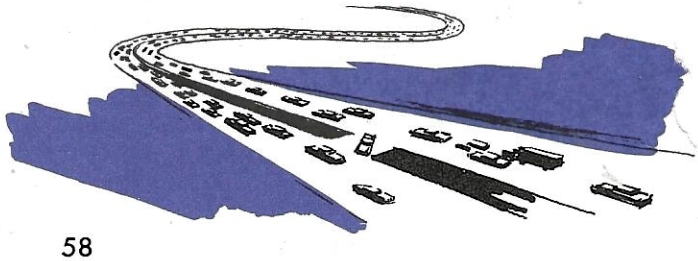
$\frac{1}{10}$ or 10% of all the people in a city were foreign born.

65% of all the books in Madison High were read each year by the students.



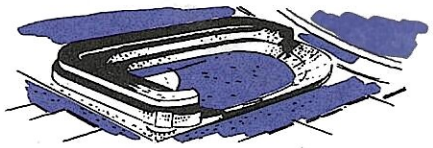
Candy consumption increased 200% over the previous year.

There are $2\frac{1}{2}$ times as many cars on the road as there were 20 years ago.



The dictionary says that per means "by" or "of" or "out of" and cent means "hundred." Putting the words together, this is of a hundred or out of a hundred, which is exactly the meaning of per cent. The whole amount of anything is always **100 per cent.** If you have a piece of paper in your hand, no matter what the size, the entire piece of paper is 100%. If you should tear a piece of paper into halves, you would have 2 pieces of paper; each one would be $\frac{1}{2}$ or 50% of the paper. Why? Tear each half into halves again, and each piece would be $\frac{1}{4}$ or 25% of the original entire piece. Why? No matter what you have, the whole or entire thing is 100%.

Yankee Stadium in New York City has a seating capacity of 70,000 people. If every seat were occupied at a World Series game, this would be ? % occupied.



What do these statements mean?

1. The Erie Railroad has completed its program of providing 100% diesel power for its freight and passenger service between New York and Chicago.

2. Book clubs are able to sell their books 25% to 50% below the retail price.

Look at the pictures on the opposite page and answer these questions:

3. Do you know how many letters the postman had? Do you know how many he carried in the bag? What fractional part of his letters was in his bag?

4. Is there a statement which tells how many people were foreign born? Do you know how many people were in the city? Would this statement be true: One out of every 10 people was foreign born? Why?

5. Was the candy consumption twice as much this year as it was last year? How do you know?

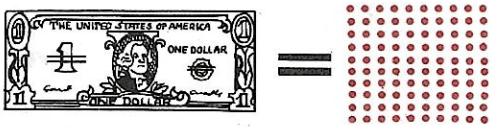
6. What would be 100% of the books in Madison High School?

7. Do you know how many more cars there are on the road today than 20 years ago?

8. What would it mean if the humidity reading was 100%?

Meaning of Per cent

Mr. Wear had a dollar bill changed into pennies at the bank, so that he could give some to his children. The $1.00 bill was 100% of the money he had changed.



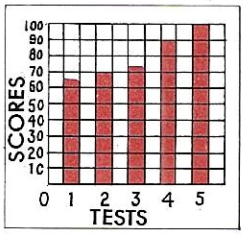
If Mr. Wear gave 2% or $\frac{2}{100}$ to Mary, how many pennies did Mary get?

If Bobby received 25% or $\frac{25}{100}$, how many pennies did he get? Donald received 10%. How many did he get?

Mr. Wear gave out 2%, 25%, and 10% of the pennies. This equals 37%. What per cent did he have left? How many pennies were left?

These per cents can be expressed as fractions and decimals.

$2\% = \frac{2}{100} = .02$ $\quad 25\% = \frac{25}{100} = .25$ $\quad 10\% = \frac{10}{100} = .10$



1. Helen made the following scores in her arithmetic tests during 5 weeks: 65, 70, 72, 90, 100. Express these scores as per cents and decimals. Can you explain the chart of Helen's marks? What improvement did she make from the first to the last test?

2. Draw a large square on the board, and divide it into 100 small squares. Show the following on this chart: 7%, 15%, 1%, 9%, $\frac{1}{2}$%. How many squares would you have to fill in to show 50%, 75%, 90%, 20%, 40%?

3. If you shaded 65 squares on the chart, what per cent would you shade? What fraction would you shade?

4. Express the following as per cents and decimals:

$\frac{93}{100}$ $\quad \frac{17}{100}$ $\quad \frac{10}{100}$ $\quad \frac{3}{100}$ $\quad \frac{21}{100}$ $\quad \frac{67}{100}$ $\quad \frac{19}{100}$ $\quad \frac{1}{100}$

5. Express the following as per cents and fractions:

.15 $\quad$ .04 $\quad$ .25 $\quad$ .74 $\quad$ .98 $\quad$ .01 $\quad$ .45 $\quad$ .86 $\quad$ .91 $\quad$ .17

6. Express these fractions as hundredths and as per cents:

$\frac{1}{2}$ $\quad \frac{1}{4}$ $\quad \frac{3}{10}$ $\quad \frac{9}{10}$ $\quad \frac{11}{20}$ $\quad \frac{7}{25}$ $\quad \frac{9}{50}$ $\quad \frac{6}{10}$ $\quad \frac{19}{20}$ $\quad \frac{4}{50}$

Changing Per cents to Decimals and Fractions

In order to do problems in per cents you must know how to change the per cents to decimals or to fractions.

To change a per cent to a decimal, drop the per cent sign and put a decimal point 2 places to the left of the last number. Why? $3\% = .03$

Mr. Johnson agreed to give Donald 5% of all the apples he picked. If he picked 20 bushels, how many apples did Donald get? He received 1 bushel. $5\% = .05 \quad .05 \times 20 = 1.00$

You can also change a per cent to a fraction by dropping the per cent sign and putting the number over a denominator of 100. Why? The fraction may then be reduced. $5\% = \frac{5}{100} = \frac{1}{20}$

1. Change these per cents first to decimals, then to fractions in their lowest terms:

65%	70%	35%	20%	15%	24%	85%	75%
40%	60%	5%	25%	95%	90%	80%	30%

2. Change these fractions to per cents:

$\frac{3}{5}$ $\frac{3}{4}$ $\frac{3}{10}$ $\frac{1}{20}$ $\frac{4}{5}$ $\frac{3}{5}$ $\frac{9}{10}$ $\frac{13}{20}$ $\frac{14}{25}$ $\frac{9}{50}$ $\frac{2}{5}$

The fractions and their equal per cents are known as equivalents because they are equal to each other. $\frac{1}{4} = 25\%$ The fraction $\frac{1}{4}$ is the equivalent of 25%. You may find it helpful to memorize these fractional equivalents:

$\frac{1}{2} = 50\%$	$\frac{1}{8} = 12\frac{1}{2}\%$	$\frac{1}{5} = 20\%$	$\frac{1}{3} = 33\frac{1}{3}\%$	$\frac{1}{10} = 10\%$
$\frac{1}{4} = 25\%$	$\frac{3}{8} = 37\frac{1}{2}\%$	$\frac{2}{5} = 40\%$	$\frac{2}{3} = 66\frac{2}{3}\%$	$\frac{3}{10} = 30\%$
$\frac{3}{4} = 75\%$	$\frac{5}{8} = 62\frac{1}{2}\%$	$\frac{3}{5} = 60\%$	$\frac{1}{6} = 16\frac{2}{3}\%$	$\frac{7}{10} = 70\%$
$\frac{2}{4} = 50\%$	$\frac{7}{8} = 87\frac{1}{2}\%$	$\frac{4}{5} = 80\%$	$\frac{5}{6} = 83\frac{1}{3}\%$	$\frac{9}{10} = 90\%$

Everyday Uses of Per cent

Not only should you know the meaning of per cent and how to find it, but you should also be able to read about per cents intelligently. Here is a group of statements cut from magazines and newspapers. See if you can read and explain them.

Now E Bonds pay 3¼%! Now, improved Series E Bonds start paying interest after 6 months
SAVE 25%
100% WOOL
100% PURE MOTOR OIL
Put Your SAVINGS to work! 3¼%
OVERDRIVE saved gas for the winners because it automatically cuts down revolutions 30%
20% DISCOUNT

See how many examples of per cent you can find in newspapers. Make a booklet or a poster out of them.

Major League Standings

AMERICAN

	W.	L.	P.C.	G.B.
New York ..	73	35	.676	..
Chicago.....	67	43	.609	7
Cleveland...	62	46	.574	11
Boston	61	51	.545	14
Washington	54	57	.486	20½
Kansas City	46	62	.426	27
Detroit.....	38	70	.352	35
Baltimore...	37	74	.333	37½

NATIONAL

	W.	L.	P.C.	G.B.
Brooklyn ...	71	37	.657	..
Milwaukee..	66	45	.595	6½
Philadelphia.	59	47	.557	11
St. Louis....	59	48	.551	11¾
New York ..	53	52	.505	16½
Cincinnati ..	49	61	.445	23
Chicago.....	41	65	.387	29
Pittsburgh..	36	79	.313	38½

These are major league standings, halfway through the season. The columns are headed: games won, games lost, per cent, and games behind. To find the per cent for New York, add the games won and games lost. $73 + 35 = 108$ games played. Then divide the games won by 108, rounding the result to 3 decimal places.

$$
\begin{array}{r}
.6759 \\
108\overline{)73.0000} \\
\underline{648} \\
820 \\
\underline{756} \\
640 \\
\underline{540} \\
1000 \\
\underline{972} \\
28
\end{array}
$$

Since the last place 9 is more than 5, add 1 to the figure preceding. The answer is .676. In baseball, this decimal is called per cent, or just 676.

1. Read all these baseball per cents using the % sign.

2. Check the per cents for Detroit and Chicago.

Finding the Per cent of a Number

Betty has \$300 in her bank account which she is saving toward a college education. She receives 2% interest on this money each year. How much money does her bank account earn the first year?

On the first \$100 she receives 2%, which is 2 of the hundredth parts of the \$100, or \$2.00.

On the second \$100 she receives 2%, which is 2 of the hundredth parts of the \$100, or \$2.00.

On the third \$100 she receives 2%, which is 2 of the hundredth parts of the \$100, or \$2.00.

Altogether she receives \$6.00 for one year.

An easier way to do the same problem would be to change the 2% to a decimal (.02) and multiply the \$300 by it.

You may change the per cent to a fraction if it is easier. For example, if the luxury tax on a \$10.00 hand bag is 10%, how much is the tax?

$$10\% \text{ of } \$10.00 = \frac{1}{10} \times \frac{10.00}{1} = \$1.00 \text{ tax}$$

Therefore, to find the per cent of a number, change the per cent to a decimal or a fraction and multiply.

1. Find answers to the following:

a.	b.	c.	d.
40% of 60	$87\frac{1}{2}\%$ of 64	$62\frac{1}{2}\%$ of 320	6% of 75
75% of 80	$66\frac{2}{3}\%$ of 99	$83\frac{1}{3}\%$ of 240	12% of 92
2% of 90	5% of 80	80% of 150	10% of 1000
$37\frac{1}{2}\%$ of 96	$33\frac{1}{3}\%$ of 100	20% of 50	17% of 862

2. Mr. Bates saves 20% of his salary of \$5,550 each year toward the purchase of a new house. How much does he save each year?

3. Out of the 45 pupils in Miss Rogers' room, 27 went to the picnic. What per cent of the pupils went? What per cent did not go?

4. During World War II, the Army used 67% of all Pullman sleeping cars for military travel. If there were 7,000 sleeping cars at that time, how many did the Army use?

Per cent — Whole Given — Finding the Part

Per cent Used in Interest

When you put money to work, the wage it receives is called **interest.** Interest is always expressed as a per cent *for one year.* To find interest in terms of money *change the per cent to a decimal and multiply.*

1. The Township High School made $450 from the spring Festival. This was put in the local bank. If the bank paid 2% interest, how much money had the $450 earned by the time the next spring Festival came? How much did Township High then have in the bank?

2% = .02 .02 × $450 = $9.00, interest

$450.00 + $9.00 = $459.00, amount

2. Mr. Jackson wanted to build a garage. The garage would cost $1,500. He borrowed the money from the Case National Bank at 5% for one year. How much money did Mr. Jackson pay for the use of the money for one year?

5% = .05
.05 × $1500 = $75, interest

$150 + $75 = $1,575, amount

The amount of money which is borrowed or saved is called the **principal.** The *per cent of interest* is called the **rate.** The *length of time* for which the interest is paid is called the **time.**

Find the interest for one year on the following:

1. $1,250 at 4%
2. $375 at 5%
3. $1,950 at 2%
4. $700 at 6%
5. $875 at 1%
6. $9,000 at 3%
7. $4,750 at 3%
8. $1,765 at 6%
9. $2,000 at 3%

10. Mr. Fox borrowed $2,000 from the bank at 6% interest for 1 year. He agreed to pay it back plus the interest in 12 monthly installments. How much did he pay each month?

11. Mr. Robinson, who owns a trucking business, bought a trailer truck that cost $14,000. He paid $4,000 cash and agreed to pay the rest at 6% interest in one year. How much would he have to pay at the end of the year?

Per cents Used in Discounts

Everyone likes to get something for less than its regular price. When you see something advertised at a discount, you become interested in the advertisement. Discount means a deduction or money taken off the regular price. This is usually expressed as a per cent.

EXTRA! Save time and trouble. Send us your gift lists and your cards. 10% discount for 12 or more expressed to one address.
POSTPAID
$4.95
PECAN BRITTLE

Mrs. Long took advantage of the above advertisement for pecan candy for her Christmas presents and ordered 12 packages to give to her family and friends. How much did they cost? The 12 packages cost $59.40. She received a discount of $5.94. She paid $53.46 for the candy.

$12 \times \$4.95 = \$59.40$
$10\% = .10$
$.10 \times \$59.40 = \$5.94$
$\$59.40 - \$5.94 = \$53.46$

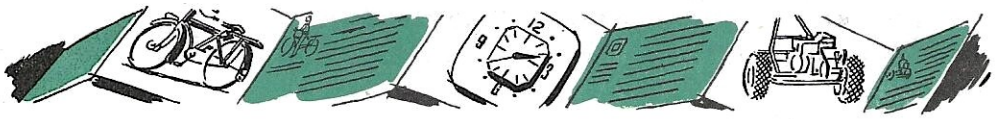
To find discount, change the per cent of discount to a decimal or fraction, and multiply.

Find the discount in each of the following and the price after discount:

1. Piano $795
   Discount 5%

2. Baby Carriage $75.00
   Discount 12%

3. Electric Stove $325
   Discount 10%



4. Bicycle $59.50
   Discount 5%

5. Clock $5.00
   Discount 5%

6. Power Mower $125
   Discount 2%

Business Uses of Per cent

Per cent is used so much in the business world that not to understand it would mean disaster for business. Every owner of a factory or store, from the local butcher or grocer to the head of a large department store, runs his business in order to make a profit.

In order to understand the use of per cent in business, there are certain terms which should be part of your vocabulary. Here is a list of some business terms. Some of them you know, and others you will learn as you proceed.

Business Terms

a. Cost	**f.** Commission	**k.** Retail
b. Selling price	**g.** Overhead	**l.** Consumer
c. Gain	**h.** Profit	**m.** Trade discount
d. Loss	**i.** Expenses	**n.** List price
e. Margin	**j.** Wholesale	

When you, *the consumer* (**l**), purchase something, you usually buy from a retailer, or you buy things *retail* (**k**). The store buys from a wholesale firm or buys things *wholesale* (**j**). Because the store buys in quantity, it gets the goods cheaper than the *list price* (**n**), which is written in the catalog of prices. It gets what is called a *trade discount* (**m**) from the wholesale house. What the storekeeper pays for his goods is called *cost* (**a**).

In order to stay in business, the storekeeper must make a *gain* (**c**) or a *profit* (**h**). If he sold things at a *loss* (**d**), he would not stay in business very long.

The storekeeper hires salespeople to sell his goods. These people are usually paid a *commission* (**f**) on what they sell. To find out what his *selling price* (**b**) should be, the owner of the store adds together his costs and what is called *margin* (**e**). A margin consists of *overhead* (**g**), including rent, heat, light, commissions, and other *expenses* (**i**), plus the profit.

$$\text{Cost} + \text{Margin}\left[\text{Overhead}\left[\begin{matrix}\text{Profit}\\ \text{heat, light, expenses,}\\ \text{commissions, rent}\end{matrix}\right]\right] = \text{Selling Price}$$

Per cents Used in Discounts

Everyone likes to get something for less than its regular price. When you see something advertised at a discount, you become interested in the advertisement. Discount means a deduction or money taken off the regular price. This is usually expressed as a per cent.

EXTRA! Save time and trouble. Send us your gift lists and your cards. 10% discount for 12 or more expressed to one address.
POSTPAID
$4.95
PECAN BRITTLE
PECAN BRITTLE

Mrs. Long took advantage of the above advertisement for pecan candy for her Christmas presents and ordered 12 packages to give to her family and friends. How much did they cost? The 12 packages cost $59.40. She received a discount of $5.94. She paid $53.46 for the candy.

$12 \times \$4.95 = \$59.40$
$10\% = .10$
$.10 \times \$59.40 = \$5.94$
$\$59.40 - \$5.94 = \$53.46$

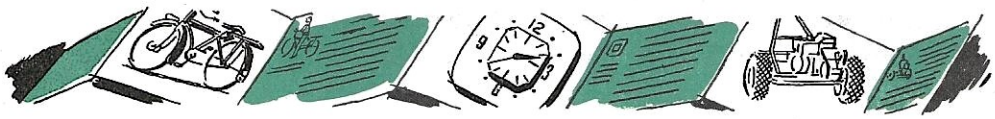
To find discount, change the per cent of discount to a decimal or fraction, and multiply.

Find the discount in each of the following and the price after discount:

1. Piano $795
   Discount 5%

2. Baby Carriage $75.00
   Discount 12%

3. Electric Stove $325
   Discount 10%



4. Bicycle $59.50
   Discount 5%

5. Clock $5.00
   Discount 5%

6. Power Mower $125
   Discount 2%

Business Uses of Per cent

When the owner of a local gift shop bought ceramics last fall, she first looked in the catalogs at the list prices. She knew from past orders that she would receive a 40% **trade discount** on the listed prices. She also knew that if she paid her bill promptly she would receive an extra 2% discount. If the owner ordered 50 vases at $1.00 each and 50 figurines at $1.50 each, how much would her final bill be, assuming that she paid her bill promptly?

The goods cost a total of $125. Check it.
Less 40% trade discount: .40 × $125 = $50.00 discount
$125.00 − $50.00 = $75.00 (cost − discount)
.02 × $75.00 = $1.50 discount for prompt payment
$75.00 − $1.50 = $73.50 amount the shop owner paid

1. 100 rose bushes were ordered by the Corner Flower Shop at $2.50 each, list price. Trade discount was 30% on orders of 50 or more. Then, there was a 2% discount for payment within 10 days. If the shop paid the bill promptly, how much did it pay?

2. The General Store of Camp Hill, Nebraska, ordered a gross of candles at $7.20 per dozen. There was a trade discount of 40% and a 2% discount for payment in 10 days. How much did the General Store pay for the candles if they had to pay a 1% freight cost on the total bill? (12 dozen = 1 gross)

3. Gift boxes were quoted in the catalog at $15.00 per 100, with a special discount of 5% on orders of 100 or more. If the gift shop ordered 1,000 boxes at a trade discount of 20%, and no discount on prompt payment, how much was the bill?

4. The Junior Clothing Shop purchased 50 boys' sweaters and 50 girls' sweaters at a list price of $3.50 each. They received a trade discount of 25% and a 3% discount for prompt payment. If the shop paid promptly, how much did they pay?

Per cents More than 100%

The eighth-grade class of the Beaver School pledged themselves to raise $50.00 by the end of the term to buy a picture for the school. Instead of the $50.00, they raised twice that amount, or $100. They had then raised 200% of their goal. If they had raised the $50.00 only, they would have raised the whole or 100%. Since they raised twice that amount, they raised 200% of their goal.

During six years the price of a certain food went up 300%. If the original price was $.15, what was the new price?

300% = 3.00
3 × $.15 = $.45 the new price

When the per cent is 100% or more, you change the per cent to a decimal by dropping the per cent sign and placing a decimal point 2 places to the left. 125% = 1.25

1. Change the following per cents to decimals:

150% 225% 175% 500% 340% 160% 1000% 145%

2. Find:

a. 150% of 40
b. 120% of 96
c. 125% of 480
d. 110% of 85
e. 102% of $1250
f. $112\frac{1}{2}$% of $750
g. $133\frac{1}{3}$% of 99
h. $216\frac{2}{3}$% of 39
i. 175% of 850

3. A book cost 88 cents. It sold for 125% of its cost. What was the selling price?

4. Wilson School has 2,240 pupils. Lincoln has 210% as many pupils. How many pupils are in the Lincoln School?

5. The average income in the United States increased about 110% from 1941 to 1954. If a man was earning $3,250 in 1941, what was his salary in 1954 if he had received this increase?

6. The Roosevelt School sold magazine subscriptions one term. They set their goal for $1500. Instead they sold 105% of their goal. What was the total amount of their sales?

Fractional Per cents

It is sometimes necessary to use a per cent less than 1%.

1. There is a small business in Pennsylvania that pays $\frac{1}{2}\%$ into the state fund for unemployment. This $\frac{1}{2}\%$ is paid on the total wages of all the employees for one year. How much money would this business pay if the total wages for the year were \$11,619? Change $\frac{1}{2}\%$ to a decimal and multiply.

$\frac{1}{2}\% = 0.00\frac{1}{2} = .005$ Why?
$\frac{1}{2}\% = 0.5\% = 0.005$ Why?
\$11,619 wages
.005
\$58.095 = \$58.10 tax

An easy way to change a fraction of 1% to a decimal is to change the fractional part to a decimal first (see second line at the left). Then, drop the per cent sign, and move the decimal point two places to the left.

2. The school tax for business people in a large eastern city is $\frac{1}{10}\%$ of the gross receipts for the year. How much would a business have to pay, if its receipts for one year were \$34,370?

$\frac{1}{10}\% = .1\% = .001$
$.001 \times \$34{,}370 = \$34.37$ tax

3. Write the following per cents as decimals:

$\frac{3}{4}\%$ $\frac{1}{8}\%$ $\frac{1}{3}\%$ $\frac{1}{4}\%$ $\frac{3}{8}\%$ $1\frac{1}{2}\%$ $2\frac{1}{4}\%$ $3\frac{1}{4}\%$ $5\frac{1}{8}\%$

4. Write the following decimals as per cents:

$.00\frac{2}{3}$ .00375 .0025 .015 .0275 .002 .004

5. Township High School sold season tickets to all games at \$5.00 a ticket. Out of the entire school of 1,250 pupils only $\frac{1}{2}\%$ did not buy tickets. How many pupils failed to buy tickets? (Give answer in round numbers.)

6. Mr. Stevens owns a small trucking business. His gross receipts for the year were \$56,350, and his total payroll was \$13,450. He pays a tax of $\frac{1}{10}\%$ on his receipts and $\frac{1}{2}\%$ on his payroll each year. How much tax does Mr. Stevens have to pay?

Comparing Values in Per cent

Linda made money during vacation by making and selling candy. She promised her brother Jack 20% of the profit if he would deliver the orders. The first week of vacation, Linda's profit was \$4.50. How much did Jack earn?

In this problem you are given the *whole* amount (\$4.50) and the *size* of the *part* (20%) to be given to Jack. You want to find the *amount of the part* that Jack receives.

Whole Amount	*Per cent of Whole*	*Amount of Part*	*Solution*
\$4.50	20%	?	\$ 4.50 × .20 = \$.9000 or $\frac{1}{5} \times \frac{4.50}{1} = .90$

This is called a problem in per cent of the *first type.*

To find the answer to a problem of this type, change the per cent to a decimal or a fraction, and multiply the whole by this decimal or fraction. Why?

The second week of vacation Linda made \$6.75. She gave Jack \$1.35. What per cent did Jack receive? Was this what he was promised?

In this problem you have the *whole amount* and the *amount of the part.* You are to find the per cent of the whole.

Whole Amount	*Per cent of Whole*	*Amount of Part*	*Solution*
\$6.75	?	\$1.35	$6.75\overline{)1.35} = .20 = 20\%$

This is called a problem in per cent of the *second type.* Sometimes it is easier to find the per cent in this way:

$\frac{135}{675} = \frac{1}{5} = .20 = 20\%$ Why?

Comparing Values in Per cent

For one week of the summer, Linda gave Jack his usual 20% which amounted to $2.60. How much profit had Linda made that week?

In this kind of problem you have the *part of the whole* and the *amount of the part.* You are to find the whole.

Whole Amount	*Per cent of Whole*	*Amount of Part*	*Solution*
?	20%	$2.60	13.00 .20)260.00 20 60

This is called a problem in per cent of the *third type.* To find your answer, you divide the amount of the part by the per cent given. Can you tell why?

In the following exercises answer the question marks:

	Whole	Per cent of Whole	Amount of Part
1.	72	?	10
2.	180	30%	?
3.	?	5%	125
4.	35	$1\frac{1}{2}\%$	?
5.	39	?	13
6.	?	32%	20
7.	$75	$\frac{1}{4}\%$	?
8.	20	?	2
9.	225	125%	?
10.	64	$12\frac{1}{2}\%$	?
11.	?	10%	45
12.	16	?	32
13.	45	?	15
14.	$95	$1\frac{3}{4}\%$	?
15.	?	4%	72
16.	$35.25	$\frac{1}{10}\%$	?
17.	$72	?	$36
18.	?	4%	32
19.	$97	$\frac{1}{2}\%$	?
20.	25.4	?	8.6

Finding Per cent of a Quantity

Find the answers to the following:

1. 10% of 120
2. $12\frac{1}{2}$% of 6480
3. $66\frac{2}{3}$% of 9063
4. $1\frac{1}{2}$% of \$95.00
5. 125% of 750
6. 200% of 13.2
7. $3\frac{1}{2}$% of \$1,500
8. 5.1% of 14750
9. $16\frac{2}{3}$% of 372
10. $37\frac{1}{2}$% of 960
11. $16\frac{2}{3}$% of \$6600
12. 122% of 4950
13. $\frac{1}{4}$% of 75
14. 4.1% of \$975
15. $\frac{1}{2}$% of \$350.50

16. The area of North America is 8,300,000 square miles. If the area of Europe is 42.2% of this amount, what is the area of Europe?

17. A real estate agent sold a house for \$17,750. He received 5% commission. How much did he receive?

18. A man earned \$6,000 last year. He saved 8% of this and spent $2\frac{1}{2}$% for pleasure. How much did he save? How much did he spend for pleasure?

19. It was clear $66\frac{2}{3}$% of the days in April. How many days were clear?

20. Last year a business house sold \$575,000 worth of goods. This year they hope to sell 125% as much. How much do they hope to sell this year?

21. Mr. Marvin's pay envelope read:

Amount earned	\$92.00
U.S. Tax	\$12.00
Social Security $2\frac{1}{4}$% =	?
City Tax $1\frac{1}{2}$% =	?

How much would Mr. Marvin take home for wages?

22. A family of four with a monthly income of \$350 spent the following: Food, 32%; Rent, 22%; Clothing, 13%; Savings, 6%. How much did they spend for each item? What per cent was left? How much money was left?

23. A new bicycle was marked 10% off, balance in 6 monthly payments. If the price was \$65, how much would be taken off the price? How much would be paid each month?

24. Mrs. Cooper bought a home freezer for \$425. She made a 20% down payment. How much did she pay? She paid a carrying charge of 3% on what remained to be paid. How much was the carrying charge?

Finding Per cent When Whole and Part Are Given

1. a. 15 is what % of 45?
b. 10 is what % of 100?
c. 5 is what % of 20?
d. 6 is what % of 30?
e. 9 is what % of 10?
f. What % of 34 is 17?
g. What % of 300 is 80?
h. What % of 125 is 75?
i. What % of 240 is 96?
j. What % of 300 is 80?
k. 75 is what % of 60?
l. 50 is what % of 200?
m. What % is 21 of 19?
n. 33 is what % of 40?
o. What % is 5 of 2?

2. Six of Miss Lee's eighth-grade class of 40 students changed to another school during summer vacation. What per cent changed schools?

3. The Smiths had a weekly income of $75.00. If they spent the following amounts, what per cent did they spend on each thing?

Food	$34.00	Recreation	$5.00	Car and gasoline	$8.00
Clothing	$9.00	Savings	$7.50	Lunches	$6.00

How much money was left? What % was left?

4. Fifty-two pupils were the winners in the magazine drive which Wilson School had last spring. If there were 2,040 pupils in the school, what per cent won top honors?

5. Mr. Hoff lives on a farm and works in the city. Each week he takes eggs to his fellow workers. On each dozen he makes 6 cents. If eggs sold at 84 cents one week, what per cent did he make?

6. Find the per cent that:

a. one cent is of one dime.
b. one quart is of one gallon.
c. one foot is of one yard.
d. eleven cents is of one dollar.
e. one day is of one week.
f. one month is of one year.
g. one hour is of 20 minutes.
h. one yard is of 6 inches.
i. one pound is of 4 ounces.
j. one year is of 9 months.

7. The population of Hatboro 10 years ago was 25,000. Today it is 55,000. By how many people has the population increased? This increase is what per cent of the population 10 years ago?

Finding Whole When Part and Per cent Are Given

1. Do the following:

a. 12 is 25% of what number?
b. 36 is 6% of what number?
c. 48 is 2% of what number?
d. 162 is 18% of what number?
e. 48 is $33\frac{1}{3}$% of what number?
f. 123 is 3% of what number?
g. 76 is 4% of what number?
h. 65 is $62\frac{1}{2}$% of what number?
i. 315 is 5% of what number?
j. 91 is $87\frac{1}{2}$% of what number?

2. Mr. Wolf left $3,600 to his son. This was 75% of all his money. How much money did Mr. Wolf have?

3. Mr. Denton pays $120 a month rent. If this is 25% of his monthly salary, how much does he make a month?

4. Mr. Benner received a dividend check for $90.00. This was a 4% dividend. How much did Mr. Benner have invested?

5. The Denton family took advantage of a sale of television sets. They paid $236, which was 80% of the original price. What was the original price?

6. The senior class at Lincoln School hired a dance band to play at their prom. It paid a commission of 12% on the door admissions. This commission amounted to $72.00. What was the total door admissions?

7. A real estate agent receives 5% of all his sales. If he received $750 for selling a house, what was the price of the house he sold?

8. A commission agent receives $2\frac{1}{2}$% for selling farmers' cattle. If he received $289.75 from one farmer, for how much had he sold the farmer's cattle?

9. Donald was taught to try to save 10% of all the money he received. At the end of the year he found that he had $23.75 in the savings bank. How much money had he received during the year?

10. A certain stock company advertised that they would pay 5% on your money invested with them. In order to make $1,000 a year, how much money would you have to invest?

Review of Per cent

1. Write each of the following as a per cent:

a. .45	**c.** .3	**e.** .125	**g.** .75	**i.** 2.5
b. .03	**d.** 3.00	**f.** .005	**h.** 1.25	**j.** .015

2. Write these per cents as whole numbers or decimals:

a. 5%	**d.** 3.5%	**g.** $33\frac{1}{3}\%$	**j.** 110%
b. 12%	**e.** 50%	**h.** $\frac{1}{2}\%$	**k.** $22\frac{1}{2}\%$
c. 101%	**f.** $\frac{1}{4}\%$	**i.** 300%	**l.** $2\frac{1}{2}\%$

3. Write these fractions as per cents:

a. $\frac{1}{2}$	**d.** $\frac{5}{8}$	**g.** $\frac{2}{3}$	**j.** $\frac{4}{5}$	**m.** $\frac{1}{6}$
b. $\frac{3}{8}$	**e.** $\frac{1}{5}$	**h.** $\frac{5}{6}$	**k.** $\frac{7}{10}$	**n.** $\frac{7}{8}$
c. $\frac{1}{4}$	**f.** $\frac{1}{3}$	**i.** $\frac{1}{25}$	**l.** $\frac{1}{20}$	**o.** $\frac{1}{12}$

4. Find the following:

a. 5% of 90
b. 16% of 176
c. 90% of 256
d. $66\frac{2}{3}\%$ of 630
e. $2\frac{1}{2}\%$ of 127
f. 2.3% of 92
g. 125% of 628
h. $\frac{1}{2}\%$ of 15
i. $3\frac{1}{4}\%$ of 176
j. 11% of 10

5. Find the following:

a. 10 is ? % of 40.
b. 15 is ? % of 60.
c. 35 is ? % of 70.
d. 90 is ? % of 1000.
e. 9 is ? % of 14.
f. What % of 200 is 300?
g. What % of 2 is 5?
h. What % of 2.3 is 2.3?
i. What % of 135 is 27?
j. What % of 50 is 75?

6. Find the following:

a. 5 is 20% of ? .
b. 70 is 25% of ? .
c. 120 is 40% of ? .
d. 9 is $\frac{1}{2}\%$ of ? .
e. 960 is 120% of ? .
f. 75 is 5% of ? .
g. 2.6 is 13% of ? .
h. 86 is 100% of ? .
i. 90 is 15% of ? .
j. 220 is 20% of ? .

7. Find the amount of discount:

a. Price \$75.00, discount 12%
b. Price \$257., discount 5%

8. Find the amount of commission:

a. Sales \$2540, commission 12%
b. Sales \$4520, commission $5\frac{1}{2}\%$

Review Problems

1. It is estimated that 7,867,000 pounds of mail were handled by the United States Post Office last year. Of this amount, the railroads handled 91%. How many pounds did the railroads handle?

2. The Navajos live on a 15,000,000 acre reservation in Arizona. There are 75,000 Navajos living on this reservation. How many acres is that for each Indian? Every three months these people send 74 delegates to a convention to make their laws. How many people are represented by each delegate?

3. A sports shop was overstocked with footballs marked $8.50 each. The storekeeper, in order to sell them, gave a 30% discount. What was the new price of the footballs?

4. A new automobile priced to sell at $2,000 in Detroit carried with it a total of $650 in local, state, and federal taxes. What per cent of the price of the car were the taxes?

5. In August 1953, the United States population reached a total of 160,000,000. What per cent was the increase over the 1950 census of 150,644,345?

6. The United States has a total of 3,022,387 square miles. Of this land, $\frac{1}{3}$ is still forest land. How many square miles are in forests?

7. A carload of apples was sold by a commission merchant for $754. If his commission was 5%, how much did he make on the carload? How much did the farmer receive?

8. James was saving to buy a new camera. When he had saved $15.00, he realized this was only 75% of the price of the camera. What was the price of the camera?

9. The bank in Huntington pays $2\frac{1}{4}\%$ interest on savings accounts. How much would Jean get in a year on her savings of $250?

10. In the Red Cross drive, 15 of Miss Wilson's students contributed the first day. What per cent of the group was this if the enrollment was 40?

11. The school had pledged itself to raise $500 for the Red Cross. On the final day the amount had gone $50.00 "over the top." By what % had the school exceeded its goal?

Practice Problems and Exercises

1. What is meant by 100 per cent?

2. How do you change a per cent to a decimal?

3. Give the fractional equivalents of as many per cents as you can.

4. How is per cent used in baseball?

5. Tell the meanings of discount, commission, list price and interest.

6. The number of lives lost by fire in the United States last year was 10,000. Of these, 2,000 were children. What per cent were children?

7. Only 8% of a 1,000 lb. steer is steak. How many pounds of steak are there from a 1,000 lb. steer?

8. In the Phillies' ball games 60 new baseballs are provided for each game. Of these, 36 are used. What per cent are used?

9. Jane has her savings in a bank that pays 2% interest a year. How much money has she in the bank if she received $7.80 interest?

10. In the Harding School 69 pupils were in the 8th grade. If this number was 30% of the total, how many students were enrolled in the school?

11. Mrs. Bruns bought a lamp for $15.50. She paid a $1\frac{3}{4}\%$ sales tax. How much tax did she pay?

Exercises:

1. Find 4% of $250.

2. $6.8 + .98 + 79.03 + .608 + 7.9$

3. $4\frac{3}{8} \times 3\frac{3}{5}$

4. $\frac{3}{10}$ of $78.50

5. Find $\frac{1}{2}\%$ of $180.

6. $14 \div .75$

7. $75 is 25% of ? .

8. $16.3 - .98$

9. Find 250% of $10.00.

10. $16 - 12\frac{1}{6}$

11. $9\frac{3}{4} \div 4\frac{1}{3}$

12. Find interest on $2,000 at $4\frac{1}{2}\%$ for 1 year.

13. Round 1,243,790 to nearest thousand.

14. $73\overline{)98}$ Answer to 2 decimal places.

15. 35.2×46.5

16. Change 15.1% to a decimal.

17. Change .001 to a per cent.

18. Find 200% of $95.50.

19. 16 is what % of 80?

20. 8 is 80% of what number?

Unit Test

1. Many states have sales taxes. One state has a tax of 2% on all purchases over \$1.00, except for food. Find the tax on the following dry goods purchases:

a. \$3.75 **b.** \$14.25 **c.** \$.98 **d.** \$2,240 **e.** \$18.75 **f.** \$50.50

2. Mr. Barr has a yearly income of \$6,200. The family spends \$820 on clothing a year. What per cent is spent on clothing yearly?

3. An electric appliance store advertised a 20% off sale. What prices would be paid on the following appliances if the original prices were:

Television Set \$275 Radio \$32.50 Air Conditioner \$395
Refrigerator \$350 Electric Fan \$37.50
Washing Machine \$410

4. Mr. Leever knew he should not spend more than 25% of his income for rent. He found an apartment for rent for \$82.00 a month. How much would he have to make a month to afford this apartment?

5. Mr. Walker, a farmer, borrowed \$2,500 for 1 yr. at $5\frac{1}{2}\%$ interest payable at the end of the year. What will he owe on the date of settlement?

6. Mrs. Fuller works in a factory 40 hours a week at \$1.25 an hour. What is her weekly wage? her annual wage? (52 weeks equal one year.)

7. Find:

a. 3% of \$65.00
b. $2\frac{1}{2}\%$ of 90
c. 65% of \$110
d. 13% of \$42
e. 125% of \$1,250
f. $\frac{1}{2}\%$ of \$2,400

8. **a.** 15 is what % of 90?
b. 36 is what % of 12?
c. What % is 42 of 84?
d. What % is 16 of 80?
e. 32 is what % of 96?
f. 50 is what % of 20?

9. **a.** 13 is 3% of what number?
b. 6 is 10% of what number?
c. \$18 is $2\frac{1}{2}\%$ of what number?
d. 96 is 5% of what number?
e. \$2.75 is 2% of what number?
f. 40 is 1% of what number?

Allyn and Bacon